The MINING CONGRESS JOURNAL

Volume 15 DECEMBER, 1929 *No. 12*

In This Issue

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THE SPIRIT OF SAFETY ~ ~ ~ RESPECTED AND IGNORED ACCORDING TO FANCIES OF MEN

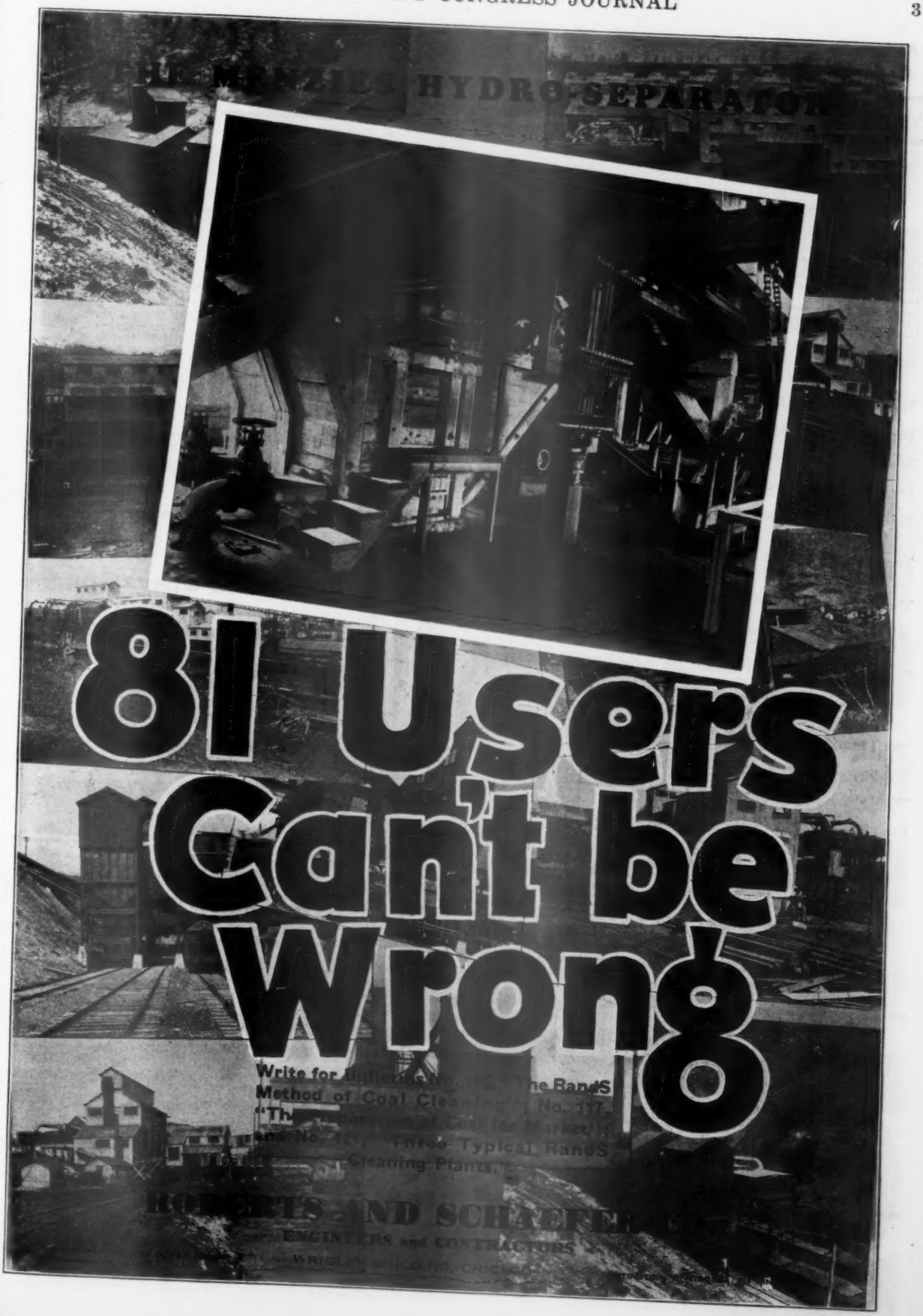
Where danger lurks you will find this spirit —never commanding, but always cautioning, and pleading for preservation of life and property. The true Spirit of Safety teaches that where dangers lurk, facts must be determined, analyzed and weighed—one against the other—before honest judgment can be passed. It has developed through countless years dating back to the beginning of mankind. To its fullest further development we are irrevocably committed.

Our closest interest in Safety lies in the promotion of proper blasting methods. When due precautions are taken, the shooting of coal is safe. But if care is not exercised at every step in this operation a hazard exists—no matter what explosives are used or how they are fired.

It is against this element of danger that we are campaigning—and against which we urge the unremitting vigilance of all coal mining executives.

Do Not "Short Fuse" --Fuse should be cut long enough for the end to extend well out of the mouth of the bore hole when the primer cartridge is in place.

THE ENSIGN-BICKFORD CO.
SIMSBURY **CONNECTICUT**


HYDRO-SEPARATOR
81 Users
Can't be
Wrong
Write for
Method of Coal
Three Typical Rands
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VOLUME 15 | DECEMBER, 1929 | No. 12

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The Banning Aerial Tramway of the Pittsburgh Coal Company

Mechanization of German Mining

Published Every Month by The American Mining Congress, Washington, D. C.

Edited under the supervision of James F. Callbreath, Secretary of The American Mining Congress

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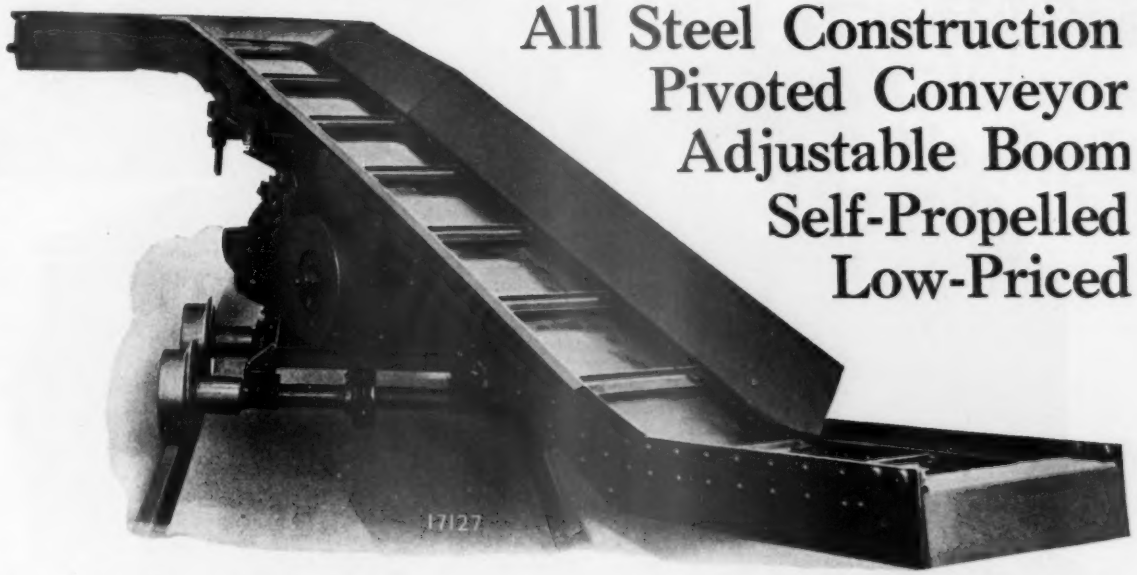
 Entered as Second Class Mail Matter January 30, 1915, at the Post Office at Washington, D. C.
YEARLY SUBSCRIPTION, UNITED STATES AND CANADA, $3.00
FOREIGN, $4.00; SINGLE COPIES, $0.30

A New Pit Car Loader

All Steel Construction
Pivoted Conveyor
Adjustable Boom
Self-Propelled
Low-Priced



This new Jeffrey 38-D Pit Car Loader combines all steel construction, flexibility to meet mine conditions, and easy handling and transporting features in an attractively low-priced machine.

The conveying unit consists of steel cross flights mounted on steel roller chain. The conveyor trough, 16½" wide, has a capacity large enough to accommodate several men shoveling onto it. The hinged conveyor boom can be raised or lowered by adjusting screws to accommodate it to height of pit car or rolls in track.

The conveyor is pivoted, which permits turning it in either direction from the track for loading. When tramming, this feature also facilitates negotiating curves where clearances are close. The conveyor is balanced on supporting trunnions so that for tramming the loading end is easily elevated and locked above the rails by pulling down on the loading boom. The four-wheel self-propelling truck makes transporting easy.

The conveyor and self-propelling truck are controlled by two independently operated jaw clutches. The Pit Car Loader can be propelled without operating the conveyor or vice versa, and when necessary the machine can be moved while conveying coal.

This loader has been designed by mining engineers who know and appreciate the hard wear that mining machinery must withstand. May we send you complete data and prices.

The Jeffrey Manufacturing Company
958-99 North Fourth St., Columbus, Ohio

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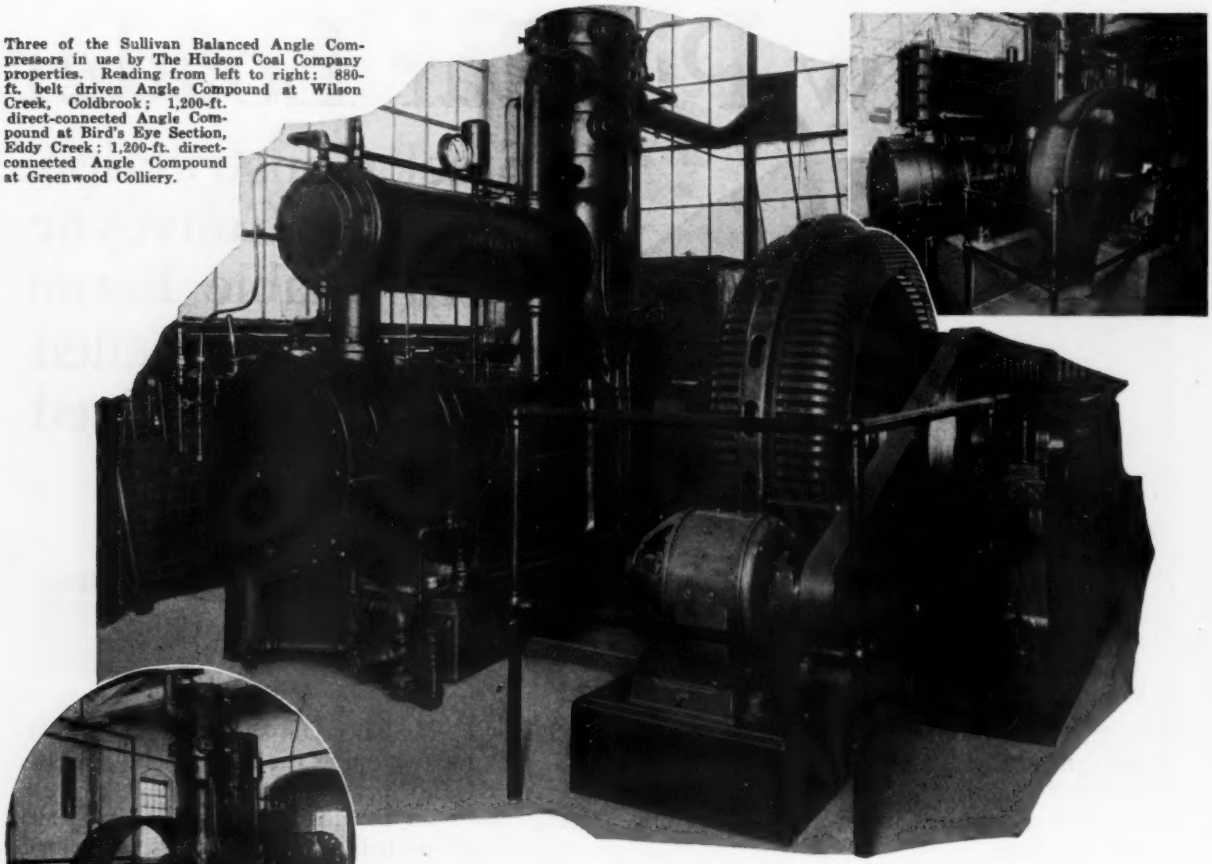
JEFFREY COAL MINE EQUIPMENT



Three of the Sullivan Balanced Angle Compressors in use by The Hudson Coal Company properties. Reading from left to right: 880-ft. belt driven Angle Compound at Wilson Creek, Coldbrook; 1,200-ft. direct-connected Angle Compound at Bird's Eye Section, Eddy Creek; 1,200-ft. direct-connected Angle Compound at Greenwood Colliery.

Sullivan Angle Compressors

Serve mines with Low Cost Air Power

HUDSON drills rock and coal with
SULLIVAN HAMMER DRILLS

—keeps its drill steel in order with
SULLIVAN ALL-HAMMER SHARPENERS

—prospects new mineral areas with
SULLIVAN DIAMOND CORE DRILLS

—pulls cars and runs scraper loaders with
SULLIVAN PORTABLE HOISTS

Post yourself on these modern, cost reducing machines.

CATALOGS ON REQUEST

THE HUDSON COAL COMPANY, important anthracite producer, is one of many mining organizations, both coal and metal, which have recognized the economies of Sullivan *Balanced* Angle Compressors.

More than 15 years ago, Sullivan engineers applied the right-angle principle to air compressors, and produced the angle compound type, with its cardinal advantages of *balance.*

Balance in angle compounds reduces vibration to practically zero. It saves power, wear and tear, and permits relatively high speeds with safety.

Angle Compressors show basic economies in floor space, installation cost and upkeep. They are readily adaptable to drive by belt, direct connected electric motor, or Diesel engine.

Half-twin and twin units, especially with direct-motor connection, secure maximum multi-unit economy.

Multi-step load control "wafer" automatic inlet and discharge valves, three-pass, counter-flow copper intercoolers and separate cylinder liners, are specific factors in Angle Compound Compressor construction which spell low cost operation.

Write for description bulletin No. 3783-J

SULLIVAN TRADE MARK

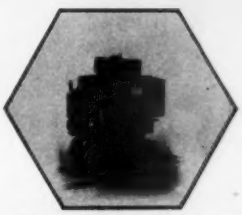
SULLIVAN MACHINERY COMPANY

801 WRIGLEY BLDG., CHICAGO

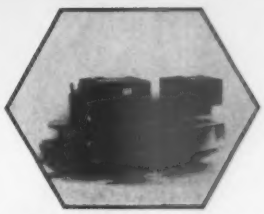
Power Haulage For Tunnels

500 lbs. rated draw bar pull

No bigger than a mine car



Jeffrey Trammer with operator's platform demounted, ready to enter a cage. Only 42 in. long now.



Note simplicity of battery transfer with pivoted transfer rack.

With trolley and cable reel.

SMALL—only 60¼ in. long, 31 in. wide, 47 in. high—but powerful—500 lbs. rated draw bar pull—maximum 800 lbs.

Built to replace hand and mule tramming and capable of fast, economical work.

Demountable operator's platform—with this off length is 42 in.—to fit in the cage.

Wheel base—26 in.—gets around sharpest curves—minimum gauge 18 in.—motor 5.5 H.P.—battery rating 7.9 to 9.4 K.W.H.

Timken roller bearings on axles—four-wheel shoe type brakes actuated by an automatically locking screw. Gears run in oil bath. Sand box on each side with non-clogging valves.

Reversing type controller—control arranged to avoid waste of power in resistance.

All electrical parts protected against drip and splash of water—everything easily accessible.

Pivoting transfer rack greatly simplifies battery transfer.

Can be supplied with trolley and cable reel instead of battery.

Built with the sturdiness which years of experience have taught Jeffrey to put into mine locomotives.

Bulletin No. 473-C *just off the press describes this compact little locomotive completely—send for a copy.*

The Jeffrey Manufacturing Company

958-99 North Fourth St., Columbus, Ohio

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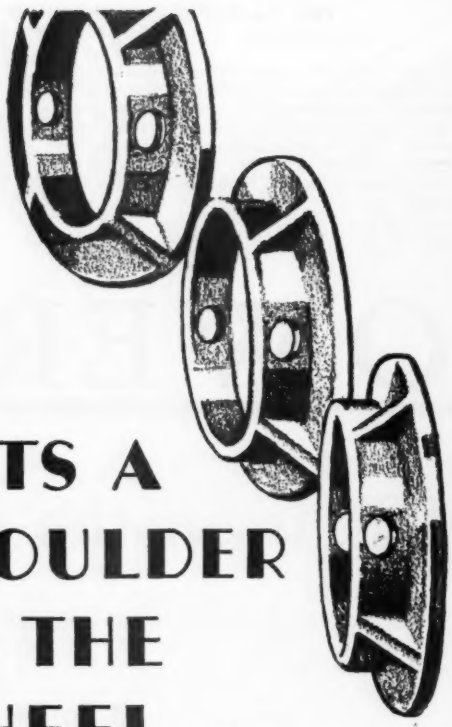
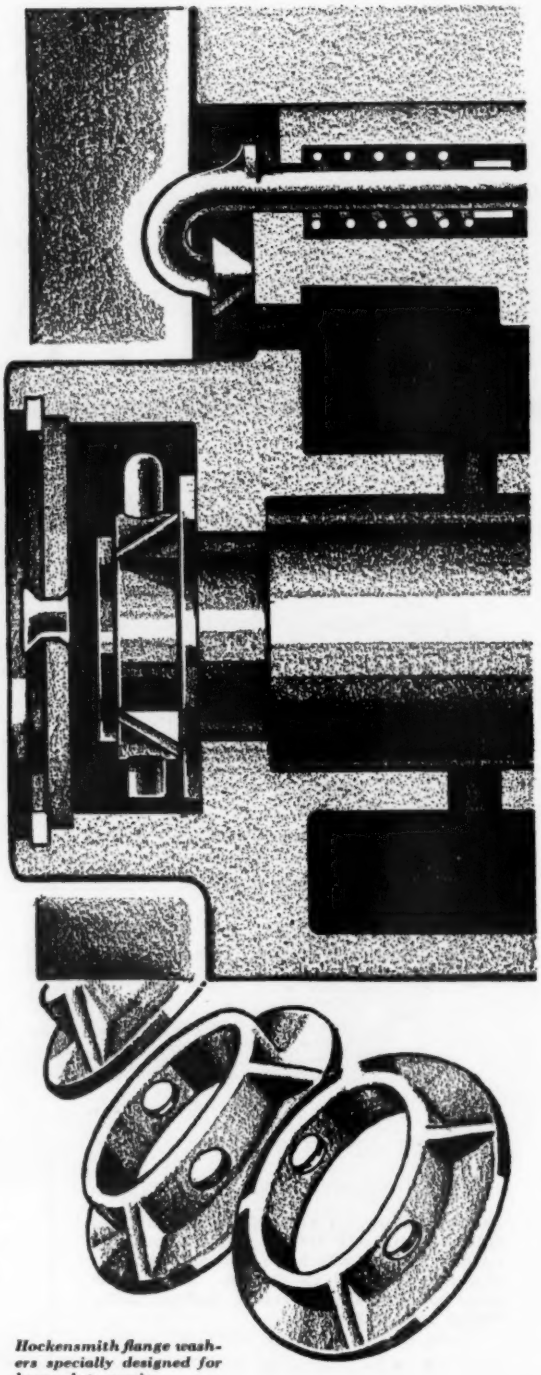
JEFFREY MINE EQUIPMENT



PUTS A SHOULDER TO THE WHEEL...



A COMBINATION OF DISC CLOSURE, FLANGE WASHER AND TWO-DIAMETER AXLE FOR PLAIN BEARING WHEELS

Disc Closure. **Retains the heavy grease in outer end of hub and protects end of axle from sand and dust.**

Flange Washer. **Provides for full bearing on outer end of hub, relieving cotter of all wear.**

Double Diameter Axle. **Assists in maintaining wheel gage; especially efficient when used in combination with flange washer and the disc closure.**

These are additional evidences of Hockensmith efforts to give the industry efficient haulage.

Hockensmith flange washers specially designed for heavy duty service.

HOCKENSMITH WHEEL & MINE CAR CO.

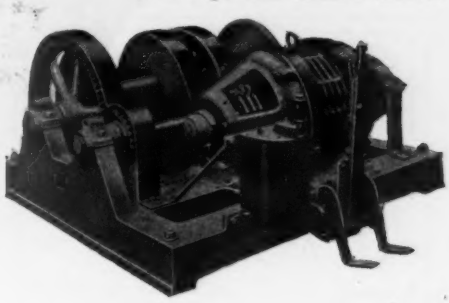
Penn, Pa. Long Distance Phone, Jeannette 700

SALES REPRESENTATIVES

Huntington, W. Va.—Huntington Supply & Equipment Co. **Knoxville, Tenn.—Webster & Co.**
Clarksburg, W. Va.—Mr. Norman Strugnell **Chicago, Ill.—W. W. Baker, 140 So. Dearborn St.**

Right into the cars from low veins

Bottomless steel scoop and two drum hoist used for scraper loading. Operated by use of wire rope and suitable sheaves



VULCAN SCRAPER LOADER

Large Capacities

Increased Production

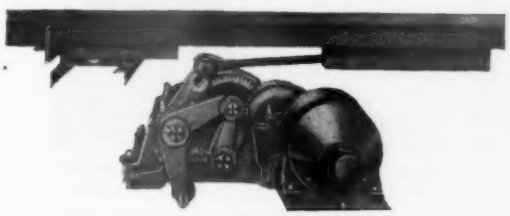
Decreased Costs

Low Cost Equipment

Flexible

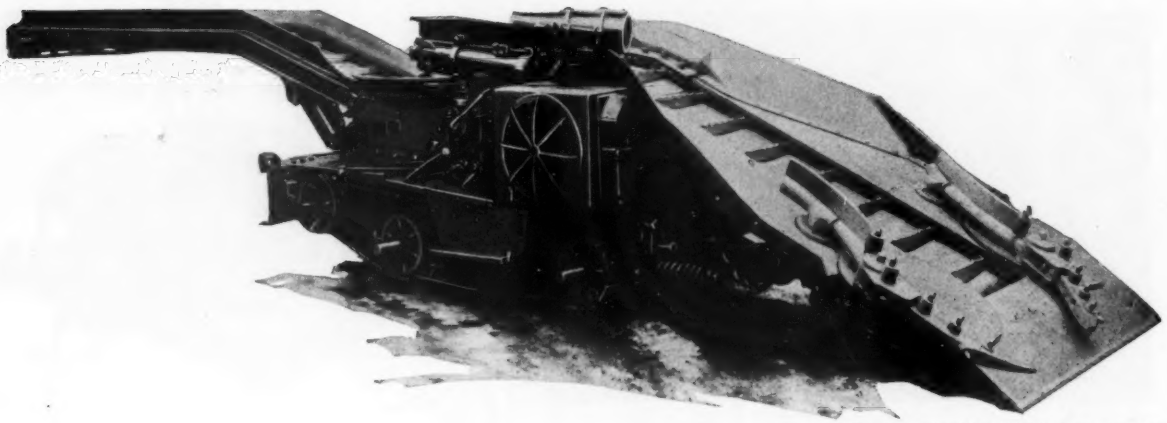
Eliminate Track Handling

VULCAN SHAKING CHUTE CONVEYORS



Conveyor drives are built in three sizes, open or enclosed types, for main or auxiliary conveyors.

VULCAN of WILKES-BARRE, PA.
MINING EQUIPMENT



The Permissible 5-BU Joy Loader

The proof of the Loader

THE proof of the Loader lies in the records it makes. A Joy has loaded as high as 860 tons in a single eight-hour shift. But more important are the records that extend over the years. One company using a number of Joy Loaders in entries averaged 197 tons per day per machine in 1926, 233 tons in 1927 and 246 tons in 1928. Another company averaged 2,783 feet of entry work in 17 days with one Triple-shifted Joy Loader, while other operations show monthly averages of more than 300 tons per shift from room and pillar production.

The reason for such records lies in the capable patented gathering mechanism, and the flexibility and completeness of the machine itself. The 5-BU Loader is made in either open or permissible types. The new 7-BU Loader makes the advantages of Joy loading available for low coal. It is 40 inches high and is guaranteed to load two tons a minute.

7-BU Joy Loader for low coal

Write for further proofs

JOY MANUFACTURING CO.

FRANKLIN, PENNA.

U. S. A.

Photo courtesy of Sullivan Machinery Company.

Every Shift—this motor keeps the Toppers busy

SCRAPERS that bring the coal over rough bottoms and through heavy piles must be dependably powered to insure quick, scheduled haulage—the kind of production that keeps the toppers at the end of the gangway busy dropping filled cars down the road and putting empties in their places.

Scraper loading is one of many mining operations in which Westinghouse type SK motors are the choice—where dependable power is essential to increased tonnage.

Strength and stamina are built into these motors making them particularly suited to mine service. The frame is constructed of rolled steel—strong without excess weight. Such high grade insulating materials as mica and Micarta protect the current carrying parts from moisture and dust. Directed ventilation under the commutator and through slots in the armature keeps the internal temperatures low and makes possible a more compact motor design.

Numerous well-equipped and efficiently-manned service shops throughout the country assure prompt service to the purchasers of Westinghouse products.

WESTINGHOUSE ELECTRIC & MFG. COMPANY
EAST PITTSBURGH PENNSYLVANIA

SALES OFFICES AND SERVICE SHOPS IN ALL PRINCIPAL CITIES

Westinghouse

T 30845

Products for the Mining Industry include:

Arc-welding Equipment	Lighting Equipment	Motors and Control
Automatic Substations	Line Material	Nuttall Speed Reducers
Electric Locomotives	Micarta Gears	Protective Devices
Insulating Materials	Motor-generators	Switchboards

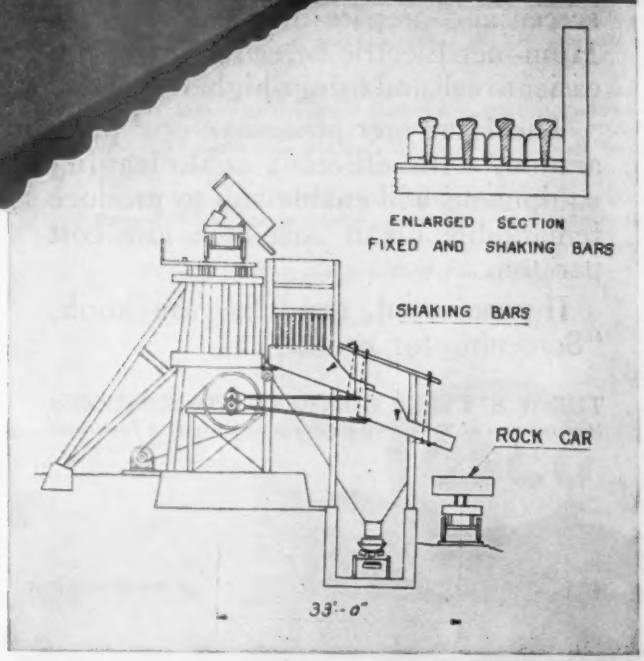
A New Standard In Iron Ore Screening

THIS Link-Belt screening plant (Patent Pending), installed for the Hanna Ore Mining Co., at Keewatin, Minn., has effected notable economies, and given a new and better method for screening iron ore.

A 30-yard iron ore mine car dumps its load sidewise into a hopper whose inclined sides are fixed manganese screen bars 4½" apart. The bottom of the hopper consists of two sets of shaking screen bars, which deliver the oversize to a rock car at one side.

The screen bars drop the screenings into a bin below, from which heavy duty apron-feeders deliver to a belt conveyor system running up into the ore washery.

Send for detailed description.



LINK-BELT COMPANY

Leading Manufacturers of Materials Handling and Power Transmission Equipment and Chains

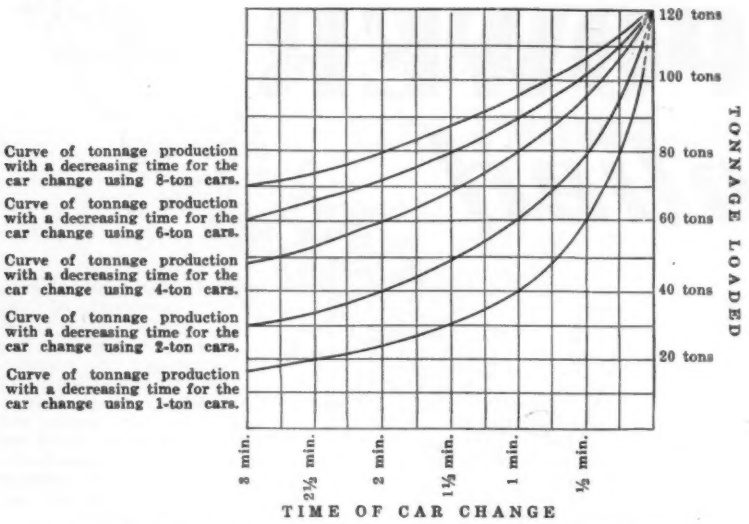
CHICAGO, 300 W. Pershing Rd. BIRMINGHAM, ALA., 229 Brown-Marx Bldg. DENVER, 520 Boston Bldg. ST. LOUIS, 3638 Olive St.
SAN FRANCISCO, 19th and Harrison Sts.

3027

LINK-BELT

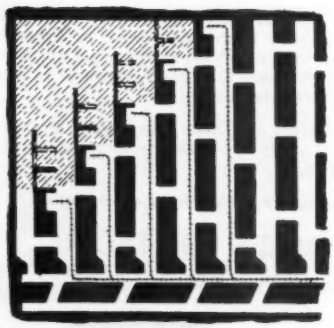
Conveying, Screening, Transmitting Equipment

The NEW YEARBOOK on

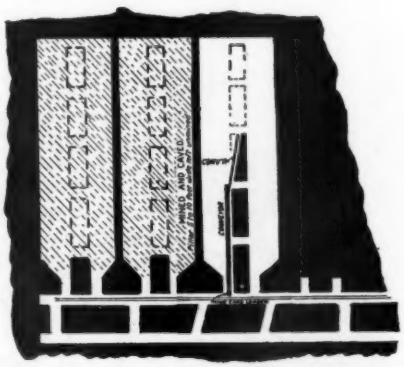


Curves showing relation between production, car capacity and time for single car changes

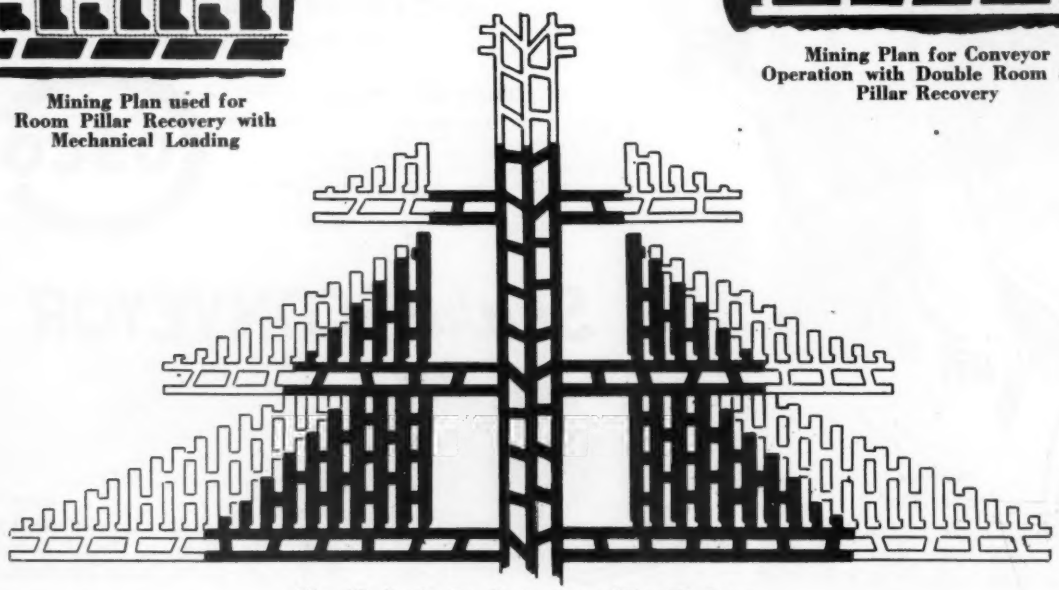
THE NEW YEARBOOK pictures graphically how mechanization is being used and what it accomplishes under all conditions and all mining systems.



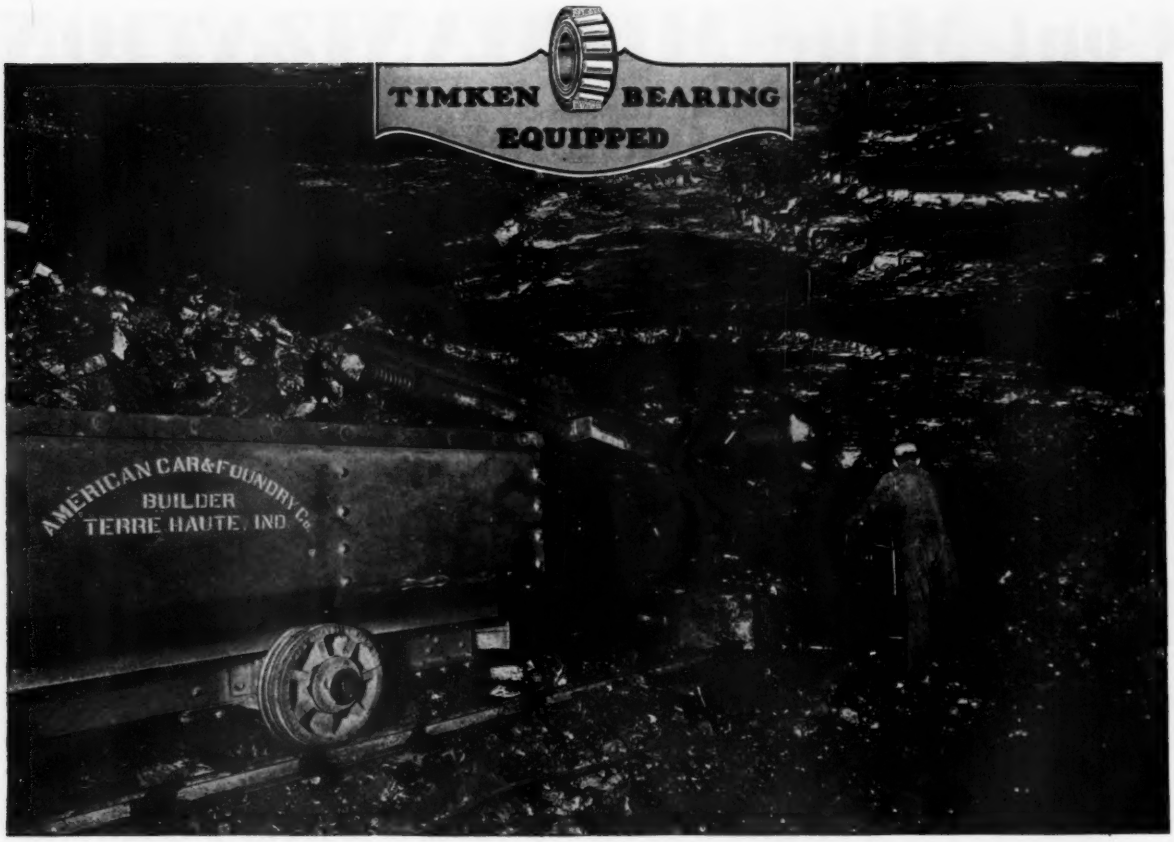
Mining Plan used for Room Pillar Recovery with Mechanical Loading



Mining Plan for Conveyor Operation with Double Room and Pillar Recovery



How Mechanization Concentrates Mine Workings



A World's Record In Coal Production With Timken-Equipped Cars

With an average of 750 Timken-equipped mine cars in regular service, 9,174,000 Tons of coal were handled at the New Orient Mine of the Chicago, Wilmington & Franklin Coal Company during a period of six years.

This tonnage constitutes a record in coal production. As a matter of fact it is a much larger amount of coal than has ever been taken from any single mine shaft in the world in an equal period of actual operating time.

The Timken-equipped cars with which this record was accomplished are still on the job and are apparently good for further years of usefulness. At the present time the New Orient Mine is operating 1100 Timken-equipped cars.

Experiences such as this explain why Timken Bearings are now almost universally used in mine cars.

Power is conserved by the elimination of friction. Production is speeded up because more loaded cars can be hauled per trip on Timkens. Radial, thrust and combined loads are fairly met and decisively defeated. Car life is extended, and maintenance costs are cut to the bone by the exclusive combination of Timken tapered construction, Timken *POSITIVELY ALIGNED ROLLS* and Timken steel.

THE TIMKEN ROLLER BEARING COMPANY, CANTON, OHIO

TIMKEN *Tapered Roller* **BEARINGS**

The
MINING CONGRESS JOURNAL
**A Monthly Magazine—The Spokesman For The Mining Industry—
Published By The American Mining Congress**

VOLUME 15 DECEMBER, 1929 No. 12

Editorials

Thirty-two Years Of Service

ON DECEMBER 4, The American Mining Congress will open its Thirty-Second Annual Convention, consummating thirty-two years of continuous service for the mining industry. Over such a period the organization has seen many changes in the industry. It has seen gold and silver at their height, and at their lowest ebbs; zinc come out of the morass into the bright light of a great industry; copper from an infant industry to a giant; lead fighting and winning its battle for supremacy; anthracite running the gamut from a monopoly to a democracy; bituminous both prince and pauper; and iron, the steady little-fluctuating mineral—the basis of the greatest of industries.

It has seen great periods of depression and great periods of prosperity in every branch of the industry. At all times it has attempted to gather together the best thought in the industry, and to lend a helping hand whenever help was needed.

The mining man is familiar with the history of this great organization, because it has been in the thick of every fight, and because its work has commanded the cooperation of mining men generally. Today its activities cover a multitude of things in which the industry is vitally interested: taxation, tariff, mechanization, standardization, legislation, minerals on public lands, forest reserves and mining, the mining school and the mine operator, publicity for the great part mining plays in our present-day civilization—to mention but a few of the things in which it is assisting.

From the creation of the Bureau of Mines to the protection and stimulation of the prospector, The American Mining Congress has led the way, because it has had the whole-hearted cooperation of the men in the industry who have vision, and who are willing to give, through their organization, of their time, money, ability and experience.

Thirty-two years of worth-while service—A record to be proud of.

Industrial Equality

THE slogan "industrial equality" is used by many people who have no conception of its practical meaning; and who apparently believe it means to put a higher tariff duty on all the things the farmer produces and to reduce the tariff on the things he must purchase. This, according to the theory of protection, would wreck the industries which furnish markets for farm produce and leave the farmer with unsold crops. What the farmer needs is a market in which his produce can be sold at a profit.

The market itself consists of a large number of people who earn sufficient wages to enable them to buy the things they need. The requirement of the farmer is for increased industrial activity which makes purchasers for a continually increasing farm output based on better farming methods.

To maintain such a market requires a practical control of production to meet probable consumption. If the Federal Farm Board can accomplish this purpose, it will be a boon to the country. This purpose will be served best by proper crop distribution and by orderly marketing.

More farmers with better farming methods and industrial stagnation with its decreased consumption will bring ruination to the farmer. More consumers and less farmers will solve the marketing problem and give the farmer industrial supremacy. Continually expanding industry with bigger payrolls which can not exist without proper tariff protection will absorb the increasing farm production based on better methods and this condition only will bring industrial equality to the farmer.

Psychology And Business

THERE is no valid excuse for any disturbance in business conditions. All of the money, all of the property, all of the machinery, all of the workmen and an equal number of consumers existing a year ago and two years ago are here now to carry on their various lines of production, fabrication, distribution and consumption. If there shall be a change in our business situation, it will be brought about by the fear that these conditions are to be changed and that in view of possible changes that the individual had better economize in his expenditures and that business had better keep close to shore. Whenever this psychology obtains in the public mind, hard times are inevitable.

The disturbing effect of tariff revision is brought about by those who fearing a change in the basis of business, withhold their orders, resulting in slowing up of business activity. The recent conference of business interests called by President Hoover with a view to averting the possible consequences of public distrust growing out of tariff agitation and the Wall Street fiasco will have a far-reaching and beneficial effect.

If big business does not falter, if the railroads continue their expansions and enlargements, if municipal governments undertake the construction of necessary public works in the regular way, the result must be a continuance of the business prosperity. The ability of the Federal Reserve Bank to prevent a money panic, the largely increased currency medium and the certainty that the country will continue to consume as it has in the past should be sufficient assurance of a continuation of business prosperity.

The Sugar Tariff

IT IS not a new thing to hear the law which protects our high wage system called a "robber tariff." To the man who thinks only of what he has to pay and gives no thought to the means by which he is able to pay, all tariffs are unconscionable and unless tariff laws are so framed that they create advantages, either directly or indirectly for every person who works for a living, the highest purpose of the law is not served.

Every section of the country is more or less dependent upon the prosperity of every other section and while the consumer of sugar, and perhaps no product is more universally used, would be pleased at a low price yet it would seem, and the history of this country justifies that theory, that he is better able to pay seven cents per pound for his sugar if the several cane and beet sugar states are prosperous than he would be to buy that sugar for five cents a pound with several states in bankruptcy and unable to consume the product of the sugar consumer. The special session of Congress was called for the particular purpose of lending aid to the farmer.

Upon no one item and in no particular is there greater opportunity for aiding the farmer than in the development of a sugar industry in the United States which is able to supply a larger part of our sugar consumption. It is estimated that the asked-for increased tariff on sugar if passed on to the consumer will average 32 cents per year for each person.

Our total consumption of sugar is about twelve billion pounds. We import from three to four billion pounds of sugar from our insular possessions duty free. We import from Cuba about six billion pounds at a preferential duty 20 percent less than the regular rate paid by other countries. We produce about two billion pounds.

If the tariff rate could be so fixed as to permit the United States to raise 75 percent of its consumption requirements, it would mean that the states of Colorado, Utah, Michigan, Idaho, Montana, California, Ohio, Louisiana, and Texas, would have about $180,000,000 more with which to buy goods. The farms so used would not be in competition with other farm products. This alone would go far toward a solution of the long standing farm problem. It would add largely to the purchasing power of the farm produce markets and take out of competition millions of acres now devoted to the cultivation of ordinary crops. No one thing would do more for the farming industry of the United States than to enable it to produce to its limit beet sugar to supply our own domestic market.

Safety Vs. The Mechanized Mine

RECORDS and facts can not be ignored. A recent questionnaire sent to a number of coal companies who are mechanized and who represent every mining field in the United States, brings out the unanimous fact that all of these mines have a lower accident rate than when they were using hand loading. This is not theory and is substantial evidence that whether mechanization automatically decreases accidents or whether mechanized mines are using more care, the records so far are decidedly in favor of machine working.

It, of course, is admitted by everyone that any machine is a potential source of accidents. This is true of mechanical loaders, scrapers, and conveyors. It is also true of the sewing machine. It is well to repeat a much used phrase and emphasize the fact that the introduction of new methods also introduces new hazards. But it is not well to use this as an argument against mechanization and it is unfair to assume that mining men are ignoring the matter of safety. It is also unfair to overlook the fact that the elimination of hand loading has also eliminated many sources of danger.

Constructive criticism is always in order and there is no place in our industrial development where safety suggestions are more welcome than in our present move to mechanize the coal mines.

Labor's Banking Adventures

AN INSIGHT into banking experiments organized under Labor auspices is given in the book published recently by Princeton University, Department of Economics, on "The Labor Banking Movement in the United States." In a statistical summary it shows 22 labor banks continuing in operation as against 17 which have been discontinued. It appears that those banks which have been successful have pursued a policy of developing business with outside interests rather than with interests inside of labor circles. Their conservative managements and their adherence to sound banking principles indicate "the permanence of the labor banking movement as it now exists."

With respect to those that have failed, the outcome is ascribed to "errors of judgment, betrayals of confidence, nepotism, inefficiency and extravagance." Misjudgment, incompetency, and self-interest and entanglement with labor-union policies could not result otherwise than in failure.

It is difficult to secure competent management and insure honest and efficient administration of any financial or business institution where the directors and executives have no substantial financial interest to be served and safeguarded. This is especially true where a management may be in a position to take long chances with other people's money with no serious risk to themselves. The Princeton book cites the case of the Engineers' Bank, organized by the Locomotive Brotherhood which at one time seemed to have achieved success. Here evidence of bad banking accumulated rapidly, and in 1925 a deplorable attempt to recoup heavy losses by turning the bank's funds into Florida real estate proved disastrous.

According to the authors labor union leaders have abandoned the policy of undertaking personal management of the banks in addition to their other responsibilities; and the diversion of labor union funds into unsuccessful banks "will soon be repaired, except where pension and insurance departments have suffered."

Insuring Prosperity

THE debacle in Wall Street in no sense reflects unstable economic conditions in American industries. President Hoover made this clear in his announcement of November 15 in which he outlined his plans for cooperation of industrial leaders and governmental agencies in developing and carrying forward constructive activities that will serve to maintain business at the present high level.

In calling meetings of representatives of industry, agriculture and labor to confer with the secretaries of the Treasury, Agriculture, Commerce and Labor and the Chairman of the Federal Farm Board, the President made it clear that he had in mind the preservation of present conditions of prosperity throughout the country. Resumption of constructive activities, development of export trade and extension of assistance to agriculture

will ward off business pessimism and any serious economic disturbance.

Satisfactory profits in business and industry, steady employment for labor at good wages, constantly increasing production and industrial expansion, and stable markets maintained by a healthy purchasing power, will prevent business and industrial stagnation and insure the continuation of prosperity.

The President did not wait for an emergency to arise. His action was not an emergency measure. He expects his Cabinet ministers and the country's business and industrial leaders to work out a program more thorough and more fundamental than could be undertaken in an emergency. At a time when the industries of the country are in a strong cash position, his purpose is to organize and co-ordinate "a forward movement of business through the revival of construction activities, the stimulation of exports, and of other legitimate business expansion."

Thus, it is planned to insure the continuation of present prosperous conditions in business and industry; improve conditions in agriculture with the use of the new power vested in the Federal Farm Board; prevent any disturbance or reduction of employment, and at the same time open up every possible avenue to new or additional employment of labor. As an added stimulus to this program, credit stability and ample capital reserves are established through the Federal Reserve System, and tax reduction is pledged. Such a program can not fail to bring together all the factors necessary to the maintainence of the nation's economic welfare.

Regulatory Bodies

THE most general complaint against public regulatory bodies has been that they do not confine themselves to the duties and functions they were created to perform. If business and industry has lost confidence in the effectiveness of Government boards and commissions, it is because these agencies have overstepped the bounds of their jurisdiction, and in order to justify their actions, have spread propaganda and developed agitation for new legislation enlarging their powers.

During the last few years state as well as Federal regulatory bodies have engaged in investigations of one sort or another which have resulted in no tangible or noticeable benefit to the public. And frequently in these investigations there has been serious interference in the policies and management of essentially private affairs. Many industries whose affairs are subject to scrutiny of these regulatory bodies have complained that it is impossible to secure fair, unbiased and nonpartisan treatment because of the attitude assumed by those in authority.

The industries of this country have grown so enormous and their problems have become so complex that undoubtedly some regulation is necessary to keep the economic situation from breaking adversely, either against the interest of the public or the interest of the industrial world. But every regulatory agency is created to perform definite functions and empowered to carry out these functions; and when they go beyond them their usefulness and effectiveness is lost, and they lose the confidence and cooperation of industry, without which they can not perform their duties efficiently.

National Manufacturers Find Business Sound

THE condition of industry throughout the country at the present time is slightly better than a year ago, according to the annual Trade Review of the National Association of Manufacturers. While some individual industries are reported as showing declines from their condition of a year ago, industry as a whole reflects a gain.

With this report before it, the public may not understand the whys and wherefores of recent breaks in the values of stocks and in the general state of affairs existing in the New York Stock Market. Recent developments in the stock market can only be explained by the fact that undue speculation has caused inflated prices on the stocks of a great variety of industries so that market quotations in many instances probably have not reflected intrinsic values and the earning power back of such stocks.

But the fact that there has been a tremendous deflation in the prices of numerous stocks and large individual losses does not indicate that the general business condition is unsatisfactory or unsound. Steel and automobiles are among the leading industries, and the report of the National Association of Manufacturers does not show anything discouraging concerning them. In the automobile group, 2 percent reported business at present poor, compared with 1 percent a year ago; and as for the winter, none report the outlook poor; 31 percent fair; 55 percent good and 14 percent excellent. Steel shows a decline from a year ago, but only 2 percent of the companies reporting describe their present business as poor against 5 percent a year ago. Increased employment is reported by 76 percent of these companies, and wage increases by 87 percent.

For several years industry generally has been moving forward at an unusual pace. Payrolls for 1929 have been larger than the preceding year and there has been no serious unemployment reported. A tight money market has handicapped industry to some extent; but the general condition is believed to be satisfactory and fundamentally sound.

This view is confirmed by both Treasury and Department of Commerce officials who have been watching the business situation closely and state that they have found no flaws in the economic structure that could be construed as carrying dangerous symptoms.

Defining a Lobbyist

SENATOR CARAWAY'S definition of a lobbyist, given in his recent radio address, covers every sort of activity that is carried on in the nation's capital or state capitals in behalf of every interest whatsoever. This, of course, includes individuals and associations, ex-Congressmen and attorneys, everyone who is employed to represent business and industry and private, corporate, partisan, or sectional interests of every sort for the purpose of supplying to any Senator or Representative, to any Legislative Committee or governmental agency, their side of any question or policy that is at issue.

Although an inquiry into "lobbying" has been agitated for some time, the present lobby investigation came about directly because of the employment by a Senator of a so-called tariff expert who was already in the employ of an industrial or trade association whose

members were vitally interested in the pending tariff measure. Already, the investigating committee has called before it a number of individuals and association representatives who were seeking tariff protection for those in whose interests they were employed. Presumably, the committee eventually will call before it every witness and spokesman for business and industry who appeared before the Ways and Means and Finance Committees during the tariff hearings.

It will be remembered that every interest in the country was invited, even urged, in the announcements issued last year by the Chairman of the the Ways and Means Committee, to appear before that committee and present their needs as well as their views in relation to a revision of the tariff. Thousands of witnesses appeared for the purpose of supplying this committee and the Finance Committee with the facts concerning the businesses, enterprises, industries or interests they represented. Is it fair to brand all of these witnesses, or any of them, as lobbyists?

The business and industrial interests of the country, generally have the best interest of the country at heart, when they present to individual members of Congress, to legislative committees, and to departmental agencies, the facts concerning their industries, their needs, and the possible effects of the numerous legislative proposals affecting them that are introduced in every session of Congress.

It can not be that members of Congress do not want the facts. It can not be that they can not distinguish between facts and propaganda. It can not be that they want to be left alone, without facts, to legislate according to caprice or whim, or partisan policy. Can it be that they need a law making so-called lobbying a crime in order to protect themselves against the possibility of stronger minds from the outside helping them to make up their minds about the right or wrong of any measure before them? The right of every citizen is involved. If Congress is offering legislative proposals inimical to industry, to whom should industry protest if not to Congress?

Bank Consolidations

THE trend toward bank consolidations, branch banks and chain banks presents many questions of vital importance to the business of the nation.

Banking is a private business which because of the fact that it handles deposits is subject to Government supervision and inspection. The control of money is a function of Government. The banking system of the country for a number of years has been so managed as to bring large profits to stockholders and at the same time, render a service to the business interests of the country which met its every requirement. This service has been enhanced by the aid of the Federal Reserve Bank which is able to bring to every local bank such support as to enable it to meet every proper local demand for credit. The local bank with this reserve fund support has been as large as the business requirements of the several communities required and has been in a position to pass upon the credits sought and to largely prevent unwise investments with borrowed money. What will be the conditions if the present trend in bank consolidations is fully consummated.

Will the localities lose the benefit of the discretion of the local banker to base credit on character as well as property? Will collateral be required as the basis of all loans? Will the requirements of credit be based on standards in which the judgment of the local banker is eliminated?

It will be a sad day for the remote communities in which banks now aid and protect local development if the community interest is eliminated and the local bankers become clerks under the control of a distant board of directors.

In a recent article in the *Saturday Evening Post*, Henry M. Dawes, former Comptroller of the Currency, points out another danger to the banks themselves which is worthy of careful consideration.

The tendency to concentration and the centralization of control says Mr. Dawes "threatens a governmental control that is similar to that now exercised over public utilities operating under franchise. If it should ever be necessary to subject the banks to the sort of control that the Interstate Commerce Commission exercises over railroads, it would be the most deadening influence that could be placed on enterprise, but Government control is the inevitable consequence of monopoly and is frequently invoked long before complete monopoly exists."

The public will be practically helpless to prevent these concentrations but it will be all-powerful in bringing about the governmental control, both state and national, which the banks themselves would regret as greatly as the public would regret the sacrifice of community control.

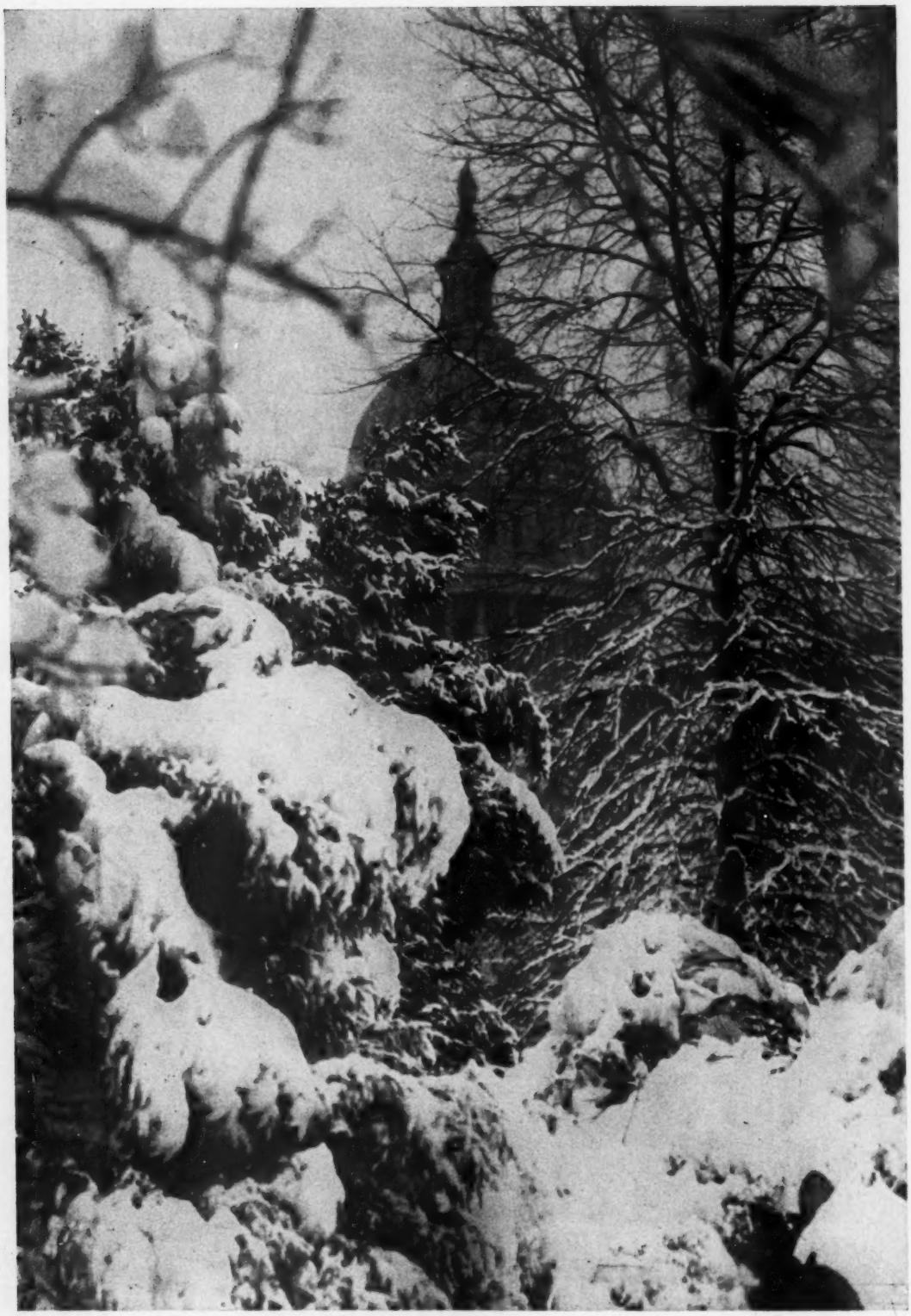
Plain Business

EVERY business benefits from cooperative effort in its sphere. Every business man knows the value of organized effort in dealing with issues or problems that are common to all engaged in enterprises or activities similar to his. Every man engaged in mining knows that there are many factors which have an influence upon the profit and loss statement of his enterprise that are outside or beyond his control.

Such factors as taxation, anti-trust and blue sky laws, state and federal regulation, freight rates, labor conditions, tariff protection, and conservation of resources, are among the numerous questions that exert both direct and indirect influences upon the operation and welfare of the mining industry to place and keep before Congress, state and legislative bodies, and state and federal regulatory agencies all the facts upon which to base intelligent and impartial action or decision.

The industrial association is a quasi public institution. In seeking to eradicate or ameliorate influences that are injurious to the welfare of its membership by every legitimate means, especially such as the assembling and compilation of accurate and detailed information for the use of legislators and governmental authorities, the association renders a commendable public service. The business of assembling accurate data and presenting and keeping the facts about an industry before Congress and its members, federal and state agencies and officials, and the public through the press, is not lobbying. Such a service is necessary and should be welcomed by those whose duties require them to deal with the complex affairs of industry from a legislative or other governmental standpoint.

While the value of the services of an effective industrial organization may not always be measurable in terms of pecuniary benefit, the influence of its activities, if it is rendering efficient service, is apparent in every instance where a business executive or an enterprise acting alone would be helpless. It is good business to affiliate with and support the association in your industry, and then demand service of it. It will pay.



Winter's Classic Staged on Capitol Hill

The WORK of The AMERICAN MINING CONGRESS

By ROBERT E. TALLY *

THE Clearing House for mining information—Organization ably assists in solving the many and intricate problems of the industry—Stabilization, Mechanization, Standards, Tariff and Taxation receive attention—A real asset to mining

IN endeavoring to outline for your understanding the work of the American Mining Congress, one is confronted with such a multitude of details wherein their work has been of great value to the mining industry, as well as to far better understanding between related industries, that it could not be adequately presented in a short discussion such as this.

The mining industry is so fundamentally essential to the progress of the country, and so intricate in its many ramifications, that it would be impossible for the many diversified interests to adequately conduct their interrelated problems except through such a medium as the American Mining Congress.

In a democracy such as ours, adequate representation is difficult to obtain by the small operator or individual who is daily confronted with problems, the solution to which lie within the scope of our law-making bodies, which have become so ponderous that only sound and adequately presented problems can be reviewed by them.

Your Mining Congress acts not only as a statistical organization, compiling data of the industry, but moreover as your representative before the Congress of the United States in presenting all the facts to that body in such form and manner that there is a minimum of delay before essential matters can be inaugurated or nonessential matters rejected.

It has not been the intention, nor should it ever be, for your Mining Congress to attempt to usurp the powers of your law-making bodies. The influence that this organization now exercises is mute evidence of the fact that they have never abused their privileges.

They are consulted regularly by your Cabinet, your Senate and the House, on a multitude of matters which come before those bodies and which require detailed expert advice before they can incorporate new ideas into existing laws or discard the many insistent demands of individuals who are interested solely in their personal problems and without regard to related matters.

Because of the standing now enjoyed by your organization, they have been able to assist you materially in general problems of representation, taxation, stabilization, standardization, mining economics and general information service.

As your representative in Congress they, by virtue of their understanding of the general problems of the industry, have been able to adequately present your difficulties to Congress, to the end that that body has been able to form a clear picture of your needs, and due to their high standing and fair and impartial presentation have inaugurated prompt and beneficent legislation. Your continued success in this work will depend on the standards you maintain and the logic and reasonableness of your requests.

In the difficult and much-abused question of taxation your organization has been able to demonstrate that mines are a wasting asset, and yet a natural resource subject to proper tax during their productive years and to modified taxation during formation or declining years.

You have only to review the methods of taxation in other countries to realize the benefits to be derived from your local methods. Much of your benefits are due to the understanding of mine taxation that your Congress has been able to convey to our tax-making bodies.

Mine taxation is one of your most important problems, and in some of your states it is equitably and intelligently handled, while in other cases politics and a spirit of "get all the industry will stand" is the basis of computation. Taxation of mines should be based on a fair cash value as well as taxation of all other classes of property.

There are two standard methods of mine valuation, both of which are satisfactory and fair if honestly and intelligently estimated. They are, physical valuation based on average prices of your product, and valuation based on capitalization of earnings.

Unfair taxation tends to discourage the development of new mines and in general retards the development of the state, and though there is no occasion for uniform state mine valuation methods, all states should use as a basis either the physical valuation or earnings method.

Without the work of the Mining Congress, conditions of taxation would surely be as chaotic as they were in the past. The importance of the work of the Tax Division can be visualized when it is realized that any change in the depletion section of the revenue law, or in the administrative regulations and rulings of the Treasury Department involving either depletion or depreciation, would affect the aggregate tax liability of the mining industry by an amount running into millions of dollars annually.

Stabilization of the industry is viewed by the American Mining Congress as the adjustment of supply and demand at prices that will be attractive not only to the producer and investor but to the consuming public as well.

The subject of stabilization, like taxation, has many ramifications and many difficulties to overcome, the greatest of which is to establish a spirit of cooperation among the members in the industry and to develop a similar understanding with the Federal Government.

The individual producer can not possibly create a spirit of cooperation nor establish an understanding on the part of the Government. It remains, therefore, for the Mining Congress, with its ability to attract the producer and with its standing in Government affairs, to accomplish for the metal industry what they have already accomplished to a

* President, The American Mining Congress. Address delivered at the Western Division meeting of the American Mining Congress, Spokane, Wash., Oct. 1, 1929.

great extent for the coal and general nonmetallic industries.

As an advocate of state rights, I feel that all of the so-called public lands should eventually revert to the states in which they are located both as to surface and subsurface rights.

We must not forget that the Federal Government has served a very useful purpose in its control of public lands during the development stages of the Western States, and though they may have had some just grievances, these have been outweighed by the benefits derived.

It is felt by many that the states are now able to look after lands within their boundaries and the Federal control offers no further advantages. If proof of this ability on the part of the states could be established by a wise and beneficial use of the surface rights of these lands, it is probable that the Government would seriously consider the transfer of such surface rights to the states and possibly the mineral rights as well. However, under the type of political control existing in some of our states it is doubtful if the benefits would equal the disadvantages of such a change in policy.

Mr. Hoover's proposal to appoint a committee for the purpose of making a complete survey of the public domain situation should receive the sincere support of the American Mining Congress.

Can you as an individual producer convince the National Government that such a radical departure from precedent should be made? I doubt it. Or can you outline and establish the laws that will regulate and control state rights to these lands? Probably not. And if it is your desire that this be brought about, then you must look to The American Mining Congress to coordinate the ideas of the industry into presentable form.

Blue-sky legislation, in which your organization is greatly interested, is largely due to abuses of the priviliges formerly granted to newly organized concerns.

We frequently get the idea in this country that we can legislate intelligence into the American people, and we inaugurate blue-sky legislation to protect the unwary investor. There is no doubt that the states should have specific laws governing the formation of new companies and the distribution of stock; however, if there is a sufficient degree of honesty in the presentation of the stock to the public, and if the funds are properly expended and accounted for, then the investor can have no complaint.

In reality, the only way that people can ever be induced to invest their funds wisely is through an educational program starting in our schools and carried through the immature years.

Work in the copper industry has demonstrated the extent to which use of copper could be increased, and no doubt a similar line of endeavor or education of the public would be beneficial in increasing investment in legitimate mining ventures.

The Bureau of Mining Economics, as the name indicates, functions as a clearing house of data pertaining to all phases of the mining industry, including lists of all mining operations, their equipment and methods, production, field for their product, as well as sources or grades of supply within areas limited by freight.

The directors of the bureau have participated in a number of economic conferences, and through broadcasting, public addresses and written articles, have done a great deal to improve national understanding of the problems of the industry. No doubt the field for such work could be greatly broadened by extending this work to our younger generation through colleges and universities.

Standardization work has progressed rapidly and we now have established the following standards: Drainage of coal mines; mine tracks and signals; outside coal-handling equipment; wire rope for mines; ladders and stair for mines; underground transportation in metal mines; mechanical loading underground in metal mines; safety rules for installing and using electrical equipment in coal mines; specifications for testing and use of permissible explosives; recommended practice for rock dusting of coal mines.

In addition, work is now being conducted on coal-mine ventilation, mine water and its action on drainage equipment, mine timber preservation, coal-mine mechanization, and many others.

Such work is being conducted by men of national reputation in the industry, and when completed will represent the best thoughts of the day.

The Southern Division has held numerous meetings, which with the books published by Dr. Henry Mace Payne, entitled "Natural Resources and National Problems" and "The Undeveloped Mineral Resources of the South," has done a great deal to improve industrial conditions in that section.

The Information and Publicity Service maintained by the Congress in direct charge of E. H. Pullman, a newspaper man of 30 years service, gives a constant survey of all mining activities developing in official Washington which shape the policy of the Government.

You enjoy a high standing in the press of the country, due to your fair and impartial handling of your problems, and as individuals you can assist in this great work by giving freely of your time in the problems that the Congress may assign to you, and by encouraging membership in this great mining organization.

National Photo

"ROCK BURSTS" IN MINES

A study of the phenomena of "rock bursts," which have cost the lives of many miners and seriolsly interfered with mining operations, has been made by the United States Bureau of Mines. Rock bursts are associately particularly with deep mining operations.

In Bulletin 309, "Rock Bursts in the Lake Superior Copper Mines, Keweenaw Point, Mich.," by W. R. Crane, just issued by the Bureau of Mines, the causes and effects of rock bursts are discussed and detailed recommendations in regard to their prevention are given.

THE CHANGING FEDERAL LANDS POLICY

By MARK WOODRUFF *

A discussion of President Hoover's Public Land proposals—Most momentous relates to reclamation by irrigation, holding unbounded potentialities for the Western states

THE title of this address was assigned by those who made up the program for this convention, and who invited me to participate in its discussion. In a moment of aberration I accepted.

The title is a misnomer. Federal lands policies are not in process of changing. Nor do we know that they will change.

The situation at the moment is that the President of the United States, a western man, a great engineer, world citizen, has had the splendid courage to suggest that "our Western States are today more competent to manage much of these affairs (public lands and reclamation service) than is the Federal Government," and he has asked the governors of the public-lands and reclamation states to recommend the names of qualified persons from among whom the President proposes to choose a commission of 9 or 10 persons, 5 of whom would be from the Western States, "that these matters may be gone into exhaustively and that I may be advised intelligently."

That request was promptly adopted by the governors in the conference at Salt Lake City on August 26-27, to whom the letter from the President was read by the Hon. Joseph M. Dixon, Assistant Secretary of the Interior. I presume the President is now in possession of names of western citizens from which he will select his commission. That is all there was to it.

The letter was entirely clear, except as to one point which I will later refer to.

The President pointed out, first, that it is his purpose to "seek every opportunity to retard the expansion of Federal bureaucracy, and to place our communities in charge of their own destinies."

Mr. Hoover then tentatively discussed some of the matters the commission might well consider. Observe, please, that he used the word "tentative" not less than four times in his letter, and he emphasized that relation in speaking of reclamation of arid lands by saying, "it must be understood that these suggestions are only tentative."

Second, the President suggested that a far better use might be made of the surface of the remaining public domain, chiefly valuable for grazing animals (and having a receding value under Federal management), if the surface rights to such lands should be turned over to the states, retaining the forest reserves, parks, minerals, and oil to the Federal Government. There are some 190 millions of acres of such grazing lands, all undesirable for agriculture. It is in the following states. I read round numbers:

Arizona	17 millions
California	20 millions
Colorado	8 millions
Idaho	11 millions
Montana	9 millions
Nevada	53 millions
New Mexico	16 millions
Oregon	13 millions
Utah	25 millions
Washington	1 million
Wyoming	17 millions

To all of the above states, except possibly Washington, the ceding of surface rights to the states is a matter of importance. All own state lands that are scattered among the Federal holdings; in many instances the states lease their holdings for substantial revenues; where the lessees fence their leaseholds they produce valuable grazing tracts, but not many do that because of the expense attached; a 640-acre pasture is of small importance to a grazer of a band of 5,000 sheep, or the owner of 500 head of cattle; but if the states owned the adjoining Federal lands, then leaseholds containing several thousands of acres

*Assistant Supervisor, Columbia Basin Survey. Presented to the meeting of the Western Division of the American Mining Congress, Spokane, Wash., Oct. 1, 1929.

Photo by courtesy, National Park Service.

would be sought after by the stockman. Grazing lands would recover their value for pasturage under fence, and it is easily to be seen that the state would gain in direct revenues as well as broaden its tax base.

If the President's commission, by any chance, should desire to turn over the forest reserves to the states, I, for one, would hesitate to assume an administrative function that costs the Federal Government twenty-four millions a year and which brings in a revenue of only five and one-half millions per annum.

The states do not have from the people anywhere near that respect for authority that is granted the Federal Government; the states would be weak on administration of the forest reserves; we would have "politics" in administrative affairs, and the trees, I fear, would soon disappear before the saw and axe.

They will go anyway, unless the forests are closed to fishermen on the streams, hunters with guns, and the tin Lizzie of the tourist. Spokane and the surrounding region are not yet clear of the smoke of the most calamitous season in the history of forest fires.

But where and how could the states finance such huge battles against fire as were waged this season?

But, mark this, in his letter to the conference of governors the President made no special reference to abuses of the public domain by metalliferous miners. He suggested reserving the "mineral resources" in my opinion, because oil comes in that category.

His letter launched directly into abuses of the public domain by holders of oil permits, though he expressed concern at unnecessary production. He pointed out that within eight days after his inauguration he had issued an order to clean up the misuses of oil permits. On March 12 last there were outstanding oil permits covering more than forty millions of acres of the public domain. Forty percent of those lessees were not complying with the law, he said, and large numbers of permits were being used to prevent honest development. It is probable that permits on thirty millions of acres of oil land will be cancelled.

I think, if I may use an interpretation, that was what the President was after in reserving all mineral rights to the Government if the surface should be ceded to the states.

The matter of mineral reservations may be safely left in the hands of any commission such a President as we have in Washington would appoint.

But the most momentous of the President's tentative suggestions, so far as western development is concerned, related to reclamation by irrigation; without which there can be no large expansion of agriculture in a region where the cities and seaports, manufacturing and export commerce, are growing many times faster than its farm development.

In his letter the President amply commits his administration to a continuation of the policy that in 27 years has converted, by Federal aid, 1,489,240 acres of sagebrush deserts into 38,000 high-powered farms, supporting 144,000 people, who last year marketed $81,000,000 of farm products; yet produced less than 1 percent of the total crop of the United States. These same farmers paid back in 1928 to the Reclamation Bureau $5,299,000 of their loan for building of dams, reservoirs, and ditches.

The President, with the broad vision of the great engineer he is, suggested (I do not quote his words) that the Federal Government's policy of flood control on the great watersheds might well begin now in the West. His scientific mind teaches him that grazing of lands to the grass roots, cutting of timber, great burnings of timber land, are sure to destroy nature's reservoirs for storing moisture, and that it is only a matter of years until the waters of our western mountains run in great seasonal floods to the sea.

His suggestion is that the Government may well build reservoirs and dams at this time as measures of flood control on western streams, and that the states in which reclamation works will hereafter be planned shall have the use of such stored waters without cost to the farmers who would use them.

That was clear. But in discussing the part the state would play in reclamation, the letter left some confusion in the minds of the members of the conference.

It is a well-known fact that reclamations of the future in the Western States will require large capital outlay. The irrigation works will require immense storage facilities, and the canals must carry water for long distances.

To illustrate: Here in Washington we are advocating the building of the Columbia Basin Irrigation Project, involving a maximum of 1,883,000 acres of arable land, and the completion of which will involve $350,000,000.

That project is entirely feasible if constructed under the present policy of the Government loaning the money on a 50-year basis without interest; but it would be downright highwaymanship to put settlers on such land if the project were constructed by private capital, at the lowest interest at which the bonds could be sold—if they could be sold at all.

Therefore, when the delegates in the conference of governors thought about the matter, the suggestion that the states have charge of the distribution works did not look so good. The Government could afford to build the reservoirs as measures of flood control, but the states could neither beg, borrow, nor steal the money to do the ditch building on large projects.

Mr. Dixon pointed out, however, that it was the President's thought that the following program be considered by the commission:

That all of the present projects be completed by the Reclamation Bureau.

That reservoirs in future be financed by the Government as measures of flood control.

That the Federal Treasury loan money as at present for the construction of ditches and water-delivery systems on future projects.

That the states exercise the control now vested in the Reclamation Bureau over irrigation districts, land settlement, etc.

Thus is outlined a program that is fraught with unbounded potentialities for the West. It is the first effort ever made at Washington to place the Western States on an equality of opportunity with the East.

It sounds like our President would take the bridle off our Pacific Slope States and have them go forward on a commercial equality with those east of the Rocky Mountains. It will be a battle between provincialism and far-sighted statesmanship.

Disguised by the cloak of "economics," the provincialists of the Congress and among their constituents will attempt to thwart the expansion of basic industries on the sunset slope of the Rockies; they will continue to argue that shipping western farm products through our Pacific ports to the Orient, and supplying seasonal dietary fruits from our regional reclamation projects to the breakfast tables of the Nation, is augmenting the surplus of wheat and corn.

Western reclamation projects grow about enough wheat to supply their own needs and a half million other people—say one city the size of Seattle. Mr. Hoover remembers that America was not built through restriction of opportunity. The figures on his desk clearly point to the trade of the countries bordering the Pacific Ocean as the roadway for the expansion we seek for the Pacific Slope States.

In the years between 1899 and 1926, exports from the ports of San Francisco, Portland, Tacoma, and Seattle jumped from about 100 million a year to nearly 600 million per annum, and of the latter amount 181 millions were products of the soil—two-thirds of the value being food products other than wheat and flour.

The demand for our land products in Oriental countries is unlimited, but to meet the com- (*Continued on page* 931)

The PUBLIC LANDS PROBLEMS

By J. F. CALLBREATH*

Important that West should understand problem—Danger of hasty decision demonstrated in case of Alaska—Western states urged to cooperate with President Hoover in his effort to solve problem

THE most important announcement to the Western States for more than 20 years was recently made by Dr. Ray Lyman Wilbur, Secretary of the Interior, at Boise, Idaho, and more recently by Hon. Joseph M. Dixon, Assistant Secretary of the Interior, at the conference of western governors at Salt Lake City.

It is equally important that the West, for whose benefit this proposal has been made, shall understand the situation, that it may act intelligently and that it shall not determine its position without full knowledge of all the facts involved. The danger of a hasty decision is well illustrated by the experience of Alaska.

At the time coal was first discovered in Alaska, many pioneers made locations upon the theory that being within the United States its law would apply to Alaskan coal reserves the same as to the coal reserves of the states.

After considerable time it was discovered that the coal-land laws of the United States did not cover Alaska. Without proper consideration of the situation, those interested in Alaska appealed to Congress for the enactment of a law making the coal-land laws of the states apply to the territory. After two years of effort this law was enacted, and shortly thereafter it was found that the laws of the states applied only to surveyed lands, and as there were no surveyed lands in Alaska the new law served no purpose. These same pioneers then appealed to Congress for a law providing that coal locations could be made by tying the claims to some natural object. After three years further effort this law was enacted, but in the meantime the conservation theory had developed and included in the latter law was a provision that no claimant could hold more than 160 acres.

It was soon recognized that 160 acres of coal lands was altogether too small an area to justify the construction of a coal-mining plant large enough to mine coal efficiently, and the next step was to ask Congress to provide for the consolidation of claims. After another three years had elapsed provision was made that coal-land claimants could consolidate to a limit of 2,560 acres. The coal claimants immediately made consolidations supposedly authorized by the law, but thereafter it was contended by the Federal Government that the consolidation law applied only to locations made after

* Address to the Western Division of the American Mining Congress, Spokane, Wash., Oct. 1, 1929.

Photo by courtesy, National Park Service.

its enactment and that there was no authority to consolidate claims located before its passage. Those who did undertake such consolidations were prosecuted by the Government for conspiracy to evade the law, and the net result of all these efforts was that practically all the coal claimants of Alaska found themselves indicted for criminal conspiracy, and in the end lost their investment.

The net result was that the coal lands of Alaska are still undeveloped, except such development as has been made by the Government, and that Alaska's industries are using coal from British Columbia and oil from California.

It has been said that the American Mining Congress is not particularly interested in this problem, and therefore it would be foolish for it to take any position. The American Mining Congress has been actively interested in these problems for 20 years. It was the American Mining Congress which first voiced a nation-wide protest through the press against the proposed leasing system by which the Federal Government proposed to gain control for all time of the power resources of the West; coal, oil, and water power.

This formed the basis of a call by the governor of Colorado for a public-lands convention in Denver, the costs of which were paid for by an appropriation made by the legislature of Colorado. At this convention, which was largely attended by prominent men from all the Western States, a Public Lands Association was formed, officers elected, and a program launched to raise funds for its support. This effort failed and again the American Mining Congress renewed its opposition to the many bills in Congress, all of which provided that the royalties from oil, coal, and water-power leases should go to the Federal Treasury.

The western Senators ably and valiantly opposed these measures and for eight years prevented their enactment. During these years all development was at a standstill and at last a compromise was agreed upon by which the states were to receive 32½ percent of the royalties for the benefit of their schools, 57½ percent of the royalties went to the reclamation fund, and 10 percent to the Federal Treasury.

That long and bitter fight has made available to Western States for school purposes millions of dollars, and many more millions of dollars has been paid into the reclamation fund.

The American Mining Congress now looks ahead to a campaign of 10 or 15 years, during which it hopes not only that the Federal Government shall turn over to the several states under proper restrictions for the protection of the public all of its holdings except the national forests, the national monuments, the national parks, and such other property as is needed for strictly governmental purposes.

Permit me to make a short review of past conditions. A little over 100 years ago, in the year 1813, Russia began to colonize California, then claimed by Mexico. She established a fort 50 miles north of San Francisco, later known as Fort Ross. This property was purchased from Russia in 1842 by General Sutter. Gold was discovered on Sutter's Creek in 1848. This territory was claimed by Mexico until 15 days after the discovery of gold, at which time the treaty was signed by Mexico ceding the western territory to the United States. Had Russia anticipated this discovery, the Mississippi River would now be the western border of our country. Had Mexico known of this discovery you would now be a part of a Mexican state.

These things did not happen, because this territory was considered too worthless to justify either of the contending nations to fight for the maintenance of its position.

For many years after 1848 this territory was considered a burden even by the United States. Our people did not realize the fructifying effect of gold upon industry. A new day dawned for the West and for the Nation. The sun of prosperity rose at Sutter's Creek, and with the production of gold and silver which followed this discovery the Nation was able to finance the Civil War and we are one Nation instead of two. In the year 1850, two years after the discovery of gold, the population of all the precious metal mining states was 178,818. Its assessed value was so small that no record is available. Over $5,000,000,000 in gold was poured from the mines of the West into the arteries of trade, which was the dominant factor in making the United States the financial dictator of the world.

During these years every effort was made by the Federal Government to people the Western States by the most liberal homestead and settlement laws.

Under this policy the West prospered, and the Nation benefited by that prosperity. Then the political reformers appeared and the danger of monopoly was used as an excuse for the withdrawal of power resource lands in 1909 for the avowed purpose of "aiding legislation." Since that time we have frothed at the mouth against bureaucracy. We have railed against the pretended right of the Federal Government to make a profit from our public lands. We fought for 10 years to prevent the passage of a law which would give the profits of leases to the Federal Government.

The question before us is not whether we shall as states accept the transfer of the surface of the public domain without the mineral rights. Not whether we shall accept responsibility for the national forests; not whether we shall give up the aid of the Federal Reclamation Service; not whether we shall part company with the Federal Bureau of Public Roads. If these problems shall present themselves some time in the future, it will then be time to consider and determine our attitude.

The question now before us is whether we will cooperate with President Hoover in working out, through a commission controlled by men of our own nomination, the whole public-lands problem about which we have been complaining and protesting ever since the first withdrawal of western power resources from location and entry, away back in the Roosevelt administration. If conditions have been satisfactory, why all the clamor?

The published proceeding of the annual conventions of the American Mining Congress alone contain more than a thousand pages of protest, and the West has everywhere, and at all times, voiced its dissatisfaction with the Federal management of our public lands under the so-called conservation policy which culminated in the Federal leasing system.

The West has not been, and is not, satisfied with the public-lands policy of the Federal Government. And now, after all these years of protest, we have a President who believes in our ability to govern ourselves and has voluntarily offered his assistance in righting the wrongs of which we have so long been complaining; a President with courage to brave the criticisms of the East which believes it has a vested interest in the public lands located in the several states. A President who does not believe that the Federal Government holds these lands as a landlord, but that Abraham Lincoln was right when he declared that "The public lands are an impermanent national possession held in trust for the maturing states." That is the principle in which President Hoover believes. If you believe in that principle and want it put into effect you will support Mr. Hoover's effort; you will cooperate with his commission, when appointed, in getting at all the facts involved, and you will not becloud the issue by bickering and objections and criticisms.

Some of the objectors insist that "If the Federal Government is to retain the forests and all the minerals it would simply be unloading a white elephant upon the states." During the fiscal year ending June 30, 1928, the entire receipts from the national forests (including timber sales, grazing fees, water power, and trespassing penalties) were $5,441,434.

During the same period the cost of administration (including $4,000,000 from the Bureau of Public Roads expended for roads in the forests) were $21,732,480, leaving a deficit of $16,291,046.

It is difficult to understand why any state should wish to assume its share of that enormous deficit, particularly in view of the fact that even with this deficit an enormous loss of more than $20,000,000 annually in timber and a loss from soil erosion many times greater has been suffered. Plainly a much larger deficit would have been justified if these irreparable losses could have been prevented.

It is equally clear that forest protection, water supply, and soil erosion are national, not state, problems. This burden must be carried by the Federal Government. It is a perfectly just Federal expenditure. The Rocky Mountain States get little if any benefit from the improvement of rivers and the construction of harbors. These states are plainly disadvantaged by the construction of the Panama Canal, to the costs of which they contributed. The maintenance of national parks and forests and the construction of public roads are among the expenses of the Federal Government which in part recompense the Western States for their contribution to other public works from which they derive little or no advantage.

The West does not want the control of nor the responsibility for the national forests, and Mr. Hoover does not propose that the national problems of forest preservation, the protection of watersheds, and the prevention of soil erosion shall be shouldered off upon the several states.

President Hoover's proposal presented to the western conference of governors in a letter to Assistant Secretary of the Interior Joseph M. Dixon included the appointment of a commission of nine, at least five of whom are to be selected from the Western States, to make a complete survey in order that "We should determine the facts in the present situation, should consider the policies now being pursued and the changes which might recommend to Congress." Mr. Hoover continues:

"These suggestions are, of course, tentative, pending investigation of the full facts, but generally I may state that it is my desire to work out more constructive policies for conservation in our grazing lands, our water storage and our mineral resources, at the same time *check the growth of Federal bureaucracy, reduce Federal interference in affairs of essentially local interest, and thereby increase the opportunity of all states to govern themselves, and in all obtain better government.*"

What more assuring words could be crowded in one sentence, looking to the settlement of public-lands problems which have been under acute discussion so many years.

"More constructive conservation of all resources," "Check the growth of Federal bureaucracy," "Reduce Federal interference in affairs of essentially local interest," "Increase the opportunity of all states to govern themselves," and "To obtain better government."

These are the principles which have been contended for by western speakers for more than 20 years.

We do not believe that any plan could be proposed better adapted to work out a fair solution of the long-standing controversies regarding public lands; nor more likely to educate the East to a proper conception of these problems, which must be done if we are to secure congressional approval of the recommendations made.

The reception given this proposal by the West has not been cordial. Objections have been based on wholly contradictory premises. No one, however, has been found ready to object to the investigation of a recognized public problem by a commission the control of which is to be vested in men from the western public-land states.

We must not lose sight of the fact that the control of public lands was one of the corner-stone principles of the so-called conservation program, nor that the defenders of that destructive program are now criticising Mr. Hoover's proposal.

The West should appreciate that no other President will ever again have the courage to draw the fire of eastern criticism for the sake of a section which fails to recognize the first helping hand offered by any President for 25 years.

THE CHANGING FEDERAL LANDS POLICY

(*From page 920*)

petition of other nations the raw materials for use of the manufacturers at tidewater must be grown on near-by land. That means more reclamation by bringing life-giving water to potentially rich soil on the near-by deserts.

Americans have captured the markets of the world through better tools, and knowing how to use them. The American farmer is entitled to the best tool he can get. His best tool is good land. The best land in the world is irrigated land.

The President appears to me to be holding out his arms to his native West with the desire in his heart to help us put our commonwealths on sound foundations. There can be no doubt about the attitude of the people of the Western States. They will support him, help him work out suitable policies—and perhaps receive much more than they now conceive of.

INCREASE IN ENROLLMENT FOR PENN STATE MINERS' EXTENSION COURSE

An enrollment of more than 1,500 miners in the second year of the extension training course provided by the Pennsylvania State College, in cooperation with the coal companies in the anthracite field, has elated officials of the college. The enrollment shows an increase of more than 200 percent, the first year's classes comprising about 500 mine employes.

The training is offered to miners in night schools at the principal centers of the hard coal region, schools being maintained in Scranton, Wilkes-Barre, Mt. Carmel, Shenandoah, Carbondale, Pottsville, and Tower City. The coal companies assisting in the work are the Philadelphia and Reading Coal and Iron Company, the Lehigh Valley, Madeira-Hill, Susquehanna Collieries, and Hudson Coal Company.

The courses offered are of a technical nature designed to prepare the men to take the state examination for certificates as foremen and fire bosses, and as assistants in those positions. The instructors are 28 men especially trained for the work by the School of Mineral Industries of the Pennsylvania State College.

Photo by courtesy, National Park Service.

LEGISLATIVE REVIEW

TARIFF REVISION bill occupies attention of Senate until close of the extra session—Regular session opens December 2 when general legislation will be considered

THE struggle which has been waged in the Senate over the tariff revision bill since early September continued to the end of the extra session of Congress on November 22. The regular session of Congress, which is fixed by the Constitution to meet on the first Monday in December of each year, will convene on December 2. The extra session, which began April 15 last, ended without final action on the tariff bill. The Senate extended its workday, which for many weeks had been from 10 a. m. to 6 p. m., to include a three-hour night session, in an attempt to complete action on the bill before the December session. Outside of individual amendments which may later be offered by Senators, the Senate had concluded consideration of what is known as the industrial rates of the bill, covering chemicals, earthenware and metals. For many weeks Senate leaders had been resisting attacks on these rates which were made by Democratic and Independent Republican Senators, but finally, in response to an appeal from the President and the Senate leader, they relaxed and permitted many changes to be made in the rates as fixed by the Finance Committee. The outstanding changes were a reduction in the duty on pig iron which carried by a slight margin, and restoration of the duty on manganese and its application to ore of a metallic manganese content of 10 percent or more, which was carried by more than a 3 to 1 vote. While waiting for the Senate to act on the tariff bill, the House, which had no other business pending for the extra session, continued to meet briefly twice a week.

When Congress meets in regular session on December 2 the gates will be open for the introduction and consideration of all types of legislation, as the recent extra session was confined solely to the consideration of farm relief legislation, which was enacted last June, and the tariff revision measure. President Hoover will outline his recommendations for legislation in a message to Congress the first week of the session. The House will then organize its committees and proceed to the consideration of bills making appropriations for the support of the Government during the next fiscal year, beginning July 1, 1930. Consideration of these measures was begun by its Appropriations Committee the middle of November so as to have some of these measures ready for action in December. The first business of the session for the Senate will be disposition of the case involving the seating of Senator-elect W. S. Vare, of Pennsylvania, who has been denied participation in Senate proceedings since his election in November, 1926. Consideration of the tariff bill will then be resumed by the Senate in the hope of passing it before the end of the year.

Tax Reduction

A Federal tax cut of $160,000,000 is expected to be made early in the session. Recommendation for this reduction has been made by Secretary of the Treasury Mellon with the approval of the President, and has been endorsed by congressional leaders who plan to pass a special bill confined to this reduction only in December, so that it may apply on 1929 income to be reported on 1930 tax returns. This reduction will comprise a cut from 12 to 11 percent in the corporation tax and a 1 percent reduction in the nominal tax on incomes of individuals and corporations ranging from $4,000 to $15,000. This tax reduction bill will not include any changes in other features of the internal revenue laws, although it had been expected that some changes might be made when the next tax reduction was decided upon. These changes would cover the present mine depletion and the gain and loss provisions of the income tax law which have been the subject of investigation by the Joint Congressional Committee on Internal Revenue Taxation. The division of investigation of the joint committee recently made a report on percentage depletion, but as the Treasury Department not yet has given its views on the subject, the officials were understood to prefer that this matter be not taken up at this time. As the session of Congress in December, 1930, will be a short one of three months, it is therefore unlikely that general tax revision will be undertaken prior to the December session of 1931.

The following is a summary of legislation before Congress during the past month:

H. R. 4811. Mr. Kelly, (Rep., Pa.). This bill proposes an appropriation of $100,000 to enable the Bureau of Mines to secure equipment, ore, and materials necessary to manufacture 1 gram of radium for use in treating war veterans at Government hospitals. Mines and Mining.

H. R. 5056. Mr. Smith (Rep., Idaho). This bill would authorize owners of patented lands to purchase not more than 640 acres of stock-raising homestead lands at $1.25 per acre. Public Lands.

H. R. 4810. Mr. Evans (Dem., Mont.). This bill proposes to add certain lands to the Helena National Forest in Montana. Public Lands.

H. R. 5180. Mr. French (Rep., Idaho). This bill proposes to add certain lands to the St. Joe and Coeur d'Alene National Forests in Idaho. Public Lands.

S. 2058. Mr. McNary (Rep., Oreg.). This bill proposes to grant 1,000,000 acres of national forest land in Oregon to the State of Oregon, the proceeds from their sale or lease to be used in the construction of buildings for the use of the state. Agriculture.

H. R. 4854. Mr. Smith (Rep., Idaho). This bill authorizes the President to add to any national forest all public lands in Idaho valuable for the protection of the flow of streams to assure water supplies for power, irrigation, or domestic purposes. Public Lands.

H. J. Res. 126. Mr. French (Rep., Idaho). This resolution provides that pending the passage of legislation defining a policy of administration of the public domain, and to prevent soil erosion, and to aid flood control, the President may withdraw from entry and from grazing use areas in any or all watersheds of existing reclamation projects. The President may, however, grant special permits (*Continued on page* 936)

Robert E. Tally
President of The American Mining Congress

32nd ANNUAL CONVENTION of The American Mining Congress

Members of American Mining Congress to hold 32nd Annual Convention at the Mayflower Hotel in Washington, D. C.—Attractive program of business and social events arranged for delegates and ladies—Men prominent in business and Government to discuss timely questions

THE THOUGHT of the mining world will be centered on Washington during the first week in December, the occasion being the 32nd Annual Convention of The American Mining Congress. These gatherings always attract leading groups of mining and other business men as they present an opportunity for the concentration of attention on the importance of the industry and its relation to the prosperity of the nation, and afford a means of reaching a common ground of understanding on the solution of problems which constantly arise in the conduct of the affairs of the industry and its relations to government agencies.

This year's convention will meet from December 4 to 7, inclusive, during which a variety of important questions affecting the mineral industry will be considered in carefully prepared addresses by leaders in the industry and men prominent in associated lines. The program will embrace a discussion of trends in industry, mineral taxation, the coal industry, mine mechanization, and the relation of government toward business. In addition to credited mining delegates, the convention will be attended by official representatives of a number of the states on appointment of their Governors, by officials of Government departments in Washington dealing with mining matters, by members of Congress, and by representatives of various organizations. State delegates have been appointed by the Governors of Pennsylvania, Idaho, West Virginia, Nevada, Maryland, Arkansas, Maine, Kentucky, Mississippi, New York and South Carolina. Among the societies to be represented are the American Society of Swedish Engineers,

William H. Lindsay
First Vice President and former President of The American Mining Congress

Jesse F. McDonald
Second Vice President of the American Mining Congress

Ohio Ceramic Industries Association, American Forestry Association, American Wholesale Coal Association, American Railway Association, Bureau of Commercial Economics, Mineralogical Society of America, International Labor Organization and American Association of Petroleum Geologists.

Coal Subjects

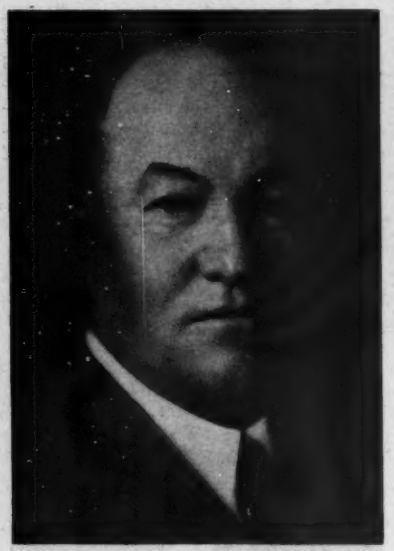
Dr. Thomas F. Baker, of Pittsburgh, president of the Carnegie Institute of Technology, will speak on developments in the coal industry through laboratory tests; the future of the coal industry will be discussed by C. J. Ramsberg, of Pittsburgh, vice president of the Koppers Company; conditions in the anthracite industry will be outlined by Daniel T. Pierce, of New York, vice president of the Anthracite Operators' Conference; Federal Radio Commissioner Ira F. Robinson will discuss the place of the commission in the present form of government; and F. A. Merrick, president of the Westinghouse Electric & Mfg. Co., speaks on "The Machine Myth." Representative John N. Robsion, of Kentucky, chairman of the House Committee on Mines and Mining, will be the toastmaster at the annual banquet.

S. Livingston Mather
Third Vice President of The American Mining Congress

Prior to the first business session of the convention the afternoon of December 4, the delegates will be entertained at luncheon at the Mayflower Hotel, where its sessions will be held, during which brief reports on the status of the various branches of the mining industry

will be made by representatives of the various districts. William H. Lindsey, of Nashville, president of the Napier Iron Works, vice president and director of The American Mining Congress, and its former president, will be chairman of the opening session which will be devoted to trends in industry.

Robert E. Tally, of Clarkdale, Ariz., vice president and general manager of the United Verde Copper Company, will speak on "Advancement of Stabilization of Industry," in the course of his report as president of The American Mining Congress during the past year. The contribution of the mining industry to the financial and economic progress of the country will be outlined by W. Mont Ferry, of Salt Lake City, president of the American Silver Producers Association, and a number of papers will be presented on the outlook for mining.



James T. Skelly
Director of The American Mining Congress

Mine Taxation

The recent report of the Division of Investigation of the Joint Congressional Committee on Internal Revenue Taxation on a proposed percentage basis for mine depletion allowances will be discussed by A. P. Ramstedt, of Wallace, Idaho, at the morning session, December 5, which will be devoted to mineral taxation questions. This session will be held under the auspices of the General Tax Committee of The American Mining Congress and will include other addresses by experts on various phases of mine taxation.

At noon, luncheon meetings will be held by the Standardization Division of The American Mining Congress, at which reports will be made by chairmen of its different committees on developments in the formulation of standards for mine practices, and by the Southern Division of The American Mining Congress, which will consider the time and place for the 1930 sessions of the Industrial Development Conference to be held in a southern city. Erskine Ramsay, of Birmingham, president of the Alabama By-Products Corporation, will preside over the meeting of the Board of Directors of the Southern Division, of which he is chairman.

Jesse B. Warriner
Director of The American Mining Congress

Questions affecting the coal industry will be considered at the afternoon session December 5, with J. B. Warriner, of Lansford, Pa., vice president and general manager of the Lehigh Coal & Navigation Company and director of The American Mining Congress, as presiding officer. Dr. Baker, of the Carnegie Institute of Technology, will speak on "The Laboratory, the Open Door to the Future in Coal," and Mr. Ramsberg, of the Koppers Company, on "Coal's Future."

Mine Mechanization

Mine mechanization will be considered by the convention at its session the morning of December 6, with J. G. Bradley, of Dundon, W. Va., president of the Elk River Coal & Lumber Company and director and former president of The American Mining Congress, presiding. "The Machine Myth" will be discussed by F. A. Merrick, president of the Westinghouse Electric & Manufacturing Co., of Pittsburgh. The National Committee on Mechanized Mining, appointed a year ago by The American Mining Congress, will submit its report through its chairman, Dr. L. E. Young, of the Pittsburgh Coal Company of Pittsburgh. The Board of Directors of The American Mining Congress will hold its annual

Louis S. Cates
Director and former President of The American Mining Congress

Stanly A. Easton
Director of The American Mining Congress

luncheon meeting at noon, at which officers and directors for next year will be chosen. At the afternoon session the relation of government to business will be considered, with Archibald Douglas, of the firm of Douglas, Armitage & McCann, of New York, presiding. At this session, Radio Commissioner Robinson will speak on the commission as an aid to industry and government. The annual banquet will be held the evening of December 6, with Mr. Tally presiding and Representative Robsion as toastmaster. There will be no formal speaking, the evening being given over to entertainment by the National Broadcasting Company. Throughout the convention entertainment will be provided

J. G. Bradley
Director and former President of The American Mining Congress

Hugh Shirkie
Director and former President of The American Mining Congress

for ladies accompanying delegates, in the form of luncheons, musicales, teas, theater parties, and dancing. Mrs. Tally, wife of the president of The American Mining Congress, and Mrs. J. F. Callbreath, the wife of its secretary, will give a tea for the ladies the afternoon of December 6 at the Mayflower Hotel. The convention will come to a close on the morning of December 7, when the delegates will make an observation tour through the U. S. Bureau of Engraving and Printing.

Convention Program

WEDNESDAY, DECEMBER 4

Informal luncheon to delegates.

AFTERNOON SESSION, DECEMBER 4

Topic—Trends in Industry.

Chairman—Wm. H. Lindsey, President, Napier Iron Works.

Papers—

"What Mining Has Contributed to

Archibald Douglas
Director of The American Mining Congress

Financial and Economic Progress of Our Country," by W. Mont Ferry, President, American Silver Producers Association.

"Advancement in Stabilization of Industry," by Robt. E. Tally, President, The American Mining Congress.

"The Lead and Zinc Industry," by R. M. Roosevelt, Vice President, The Eagle-Picher Lead Co.

"Bituminous Coal."

"Anthracite."

"Gold," by Bruce Yates, General Manager, Homestake Mining Co.

"Iron," by S. L. Mather, Vice President, The Cleveland-Cliffs Iron Co.

"Silver."

"Western Problems," by J. F. Callbreath, Secretary, The American Mining Congress.

"Mineral Taxation," by McKinley W. Kriegh, Chief, Tax Division, The American Mining Congress.

MORNING SESSION, DECEMBER 5

Topic—Mineral Taxation.

Chairman—S. L. Mather, Vice President, The Cleveland-Cliffs Iron Co.

Papers—

"Discussion of Official Report on Depletion to Joint Committee on Internal Revenue Taxation," by A. P. Ramstedt, Wallace, Idaho.

"Percentage Depletion," by L. C. Graton, Professor of Mining Geology, Harvard University.

"Legal Concept of Depletion," by Paul Armitage, of Douglas, Armitage & McCann, New York City.

"Analytic Valuations in Income Taxation of Mines," by R. C. Allen, Oglebay, Norton & Co., Cleveland, Ohio.

"Corporate Distributions From Depletion and Depreciation Reserves," by R. S. Gayton, Income Tax Unit, Washington, D. C.

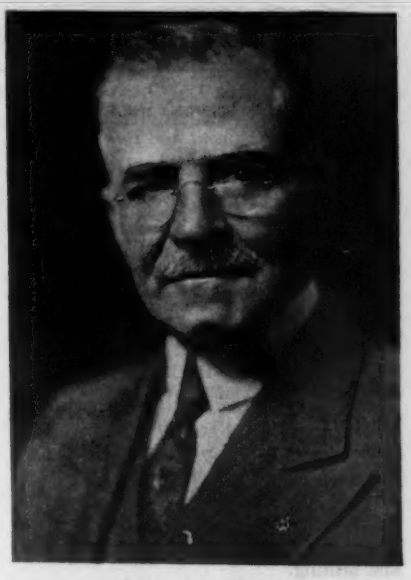
AFTERNOON SESSION, DECEMBER 5

Topic—The Coal Industry.

Chairman—J. B. Warriner, Vice President and General Manager, Lehigh Coal & Navigation Co.

Papers—

"Coal By-Products," by C. J. Rams-



James F. Callbreath
Secretary of The American Mining Congress

berg, Vice President, Koppers Company.

"The Laboratory the Open Door to the Future in Coal," by Dr. Thomas F. Baker, President, Carnegie Institute of Technology.

"The Anthracite Industry," by Daniel T. Pierce, Vice Chairman, Anthracite Operators' Association.

MORNING SESSION, DECEMBER 6

Topic—Mechanization.

Chairman—J. G. Bradley, President, Elk River Coal & Lumber Co.

Papers—

"The Machine Myth," by F. A. Merrick, President, Westinghouse Electric and Manufacturing Co.

Meeting, National Committee on Mechanized Mining, Dr. L. E. Young, Chairman.

Previous Annual Conventions of The American Mining Congress

DATE		CITY	PRESIDENT
1st	July, 1897	Denver, Colo.	Hon. Alva Adams, Pueblo, Colo.
1st	July, 1897	Denver, Colo.	Hon. L. Bradford Prince, Santa Fe, N. Mex.
2nd	July, 1898	Salt Lake City, Utah.	Hon. L. Bradford Prince, Santa Fe, N. Mex.
3rd	July, 1899	Milwaukee, Wis.	Col. B. F. Montgomery, Cripple Creek, Colo.
3rd	June, 1900	Milwaukee, Wis.	Col. B. F. Montgomery, Cripple Creek, Colo.
4th	July, 1901	Boise, Idaho.	Hon. L. Bradford Prince, Santa Fe, N. Mex.
5th	Sept., 1902	Butte, Mont.	E. L. Shafner, Cleveland, Ohio.
6th	Sept., 1903	Deadwood and Lead, S. Dak.	Hon. J. H. Richards, Boise, Idaho.
7th	Aug., 1904	Portland, Oreg.	Hon. J. H. Richards, Boise, Idaho.
8th	Nov., 1905	El Paso, Tex.	Hon. J. H. Richards, Boise, Idaho.
9th	Oct., 1906	Denver, Colo.	Hon. J. H. Richards, Boise, Idaho.
10th	Nov., 1907	Joplin, Mo.	Hon. J. H. Richards, Boise, Idaho.
11th	Dec., 1908	Pittsburgh, Pa.	Hon. J. H. Richards, Boise, Idaho.
12th	Oct., 1909	Goldfield, Nev.	Hon. J. H. Richards, Boise, Idaho.
13th	Oct., 1910	Los Angeles, Calif.	Dr. E. R. Buckley, Rolla, Mo.
14th	Oct., 1911	Chicago, Ill.	John Dern, Salt Lake City, Utah.
15th	Nov., 1912	Spokane, Wash.	Samuel A. Taylor, Pittsburgh, Pa.
16th	Oct., 1913	Philadelphia, Pa.	David W. Brunton, Denver, Colo.
17th	Dec., 1914	Phoenix, Ariz.	Carl Scholz, Chicago, Ill.
18th	Sept., 1915	San Francisco, Calif.	Carl Scholz, Chicago, Ill.
19th	Nov., 1916	Chicago, Ill.	Carl Scholz, Chicago, Ill.
20th	Dec., 1917	Members Meeting, N. Y.	Walter Douglas (Pres.), N. Y.
21st	Dec., 1918	Members Meeting, N. Y.	Walter Douglas (Pres.), N. Y.
	1917–18		No Convention, account war.
22nd	Nov., 1919	St. Louis, Mo.	Bulkeley Wells, Denver, Colo.
23rd	Nov., 1920	Denver, Colo.	W. J. Loring, San Francisco, Calif.
24th	Oct., 1921	Chicago, Ill.	W. J. Loring, San Francisco, Calif.
25th	Oct., 1922	Cleveland Ohio.	Sidney J. Jennings, New York City.
26th	Sept., 1923	Milwaukee, Wis.	H. W. Seaman, Chicago, Ill.
27th	Sept., 1924	Sacramento, Calif.	L. S. Cates, Salt Lake City, Utah.
28th	Dec., 1925	Washington, D. C.	D. B. Wentz, Philadelphia, Pa. (deceased). Hugh Shirkie, Terre Haute, Ind. (successor).
29th	Dec., 1926	Washington, D. C.	Wm. H. Lindsey, Nashville, Tenn.
30th	Dec., 1927	Washington, D. C.	J. G. Bradley, Dundon, W. Va.
31st	Dec., 1928	Washington, D. C.	Robt. E. Tally, Clarkdale, Ariz.

AFTERNOON SESSION, DECEMBER 6

Topic—Government and Business.

Chairman — Archibald Douglas, of Douglas, Armitage & McCann.

Papers—

"The Business of Government."

"The Government of Business."

"The Commission As An Aid to Industry and Government," by Ira F. Robinson, Federal Radio Commission.

EVENING, DECEMBER 6

Banquet—Grand Ball Room, Mayflower Hotel (A Speechless Dinner.)

Presiding Officer—Robt. E. Tally, President, The American Mining Congress.

Toastmaster—Hon. John M. Robsion, Chairman, House Committee on Mines and Mining.

Invocation—Dr. U. G. B. Pierce.

Special Entertainment arranged by the National Broadcasting Company.

LEGISLATIVE REVIEW

(From page 932)

for grazing or other use of the areas within such withdrawals. Public Lands.

H. J. Res. 124 and 125. Mr. Britten (Rep., Ill.). These resolutions authorize the Department of Commerce to establish commodity quantity units for general use in merchandising after 1935, standardizing the yard to the meter, the quart to the liter, and the pound to 500 grams decimally divided; and for investigation by the department and report in six months as to the advantages or disadvantages of the general use of the metric system of weights and measures. Coinage, Weights, and Measures.

H. R. 5060. Mr. Edwards (Dem., Ga.). This bill provides for the registration with the Treasury Department by persons or corporations before they can advertise or send through the mail or otherwise offer for sale in interstate trade, any stocks, bonds, certificates, or foreign securities. The registration would include full particulars as to the capital, assets, and liabilities upon which the securities are based, their book and par value, and the names and addresses of the officers and directors of the organizations issuing them. Persons failing to register would be subject to a fine of not less than $10,000 or imprisonment for one or three years. Judiciary.

S. Res. 144. Mr. Nye (Rep., N. Dak.). This resolution provides for investigation and report by February by a committee of five Senators, including two members each from the Judiciary and Banking Committees, relating to speculative operations connected with stock exchanges. The resolution states that speculative operations threaten the stability of the industrial life of the country.

S. 1930 and 1939. Mr. Smoot (Rep.) and Mr. King (Dem.), Utah. These bills provide for the construction of the Flaming Gorge irrigation and power project on the Green River in Utah. The Smoot bill provides an appropriation of $18,000,000 and the King bill $10,000,000. Irrigation.

S. Res. 124. This resolution authorizes the Federal Power Commission to make available information it may have of value to a commission of the State of New York which is investigating public utilities. Passed by the Senate.

S. Res. 145. Mr. Schall (Rep., Minn.). This resolution authorizes the Senate Committee on Interstate Commerce to investigate circumstances surrounding the application of the Rocky Mountain Power Company for the development of power sites on Indian lands in Montana.

S. Res. 151. This resolution directs the Federal Trade Commission to report every three months as to the quantity of electrical energy used for the development of power or light generated in any state, and transmitted by any means into any other state, or between points within the same state, but through any place outside the state; the percentage of electrical energy generated in each state which is transmitted to other states, and the percentage consumed in each state which is imported from other states; and to report the names of persons, corporations, and associations generating and transmitting such electrical energy. Passed by the Senate.

S. Res. 154. Mr. Frazier (Rep., N. Dak.). This resolution requests an opinion of the Engineer Corps of the Army as to the merits of a deep waterway for seagoing vessels from near St. Louis to the Gulf of Mexico, and its advisability as a means of flood control.

S. Res. 129. This resolution authorizes a committee of five Senators to investigate all activities of the Shipping Board, especially as to the sale of ships. Reported by the Expenses Committee.

S. J. Res. 80. Mr. Edge (Rep., N. J.). This resolution authorizes an appropriation of $1,150,000 for investigation by the War Department as to the practicability of constructing the Nicaraguan Canal. Interoceanic Canals.

H. R. 5052. Mr. Browne (Rep., Wis.). This bill is designed to prohibit lobbying by requiring the registration of persons conducting such activities before Congress. Judiciary.

S. 2078. Mr. Keyes (Rep., N. H.). By request. This bill appropriates $10,000,000 for extension of education through a commission of three persons, including instruction in the applications of science and mechanics to the work of the world.

PLAN HIGHWAY FROM UNITED STATES BOUNDARY TO ALASKA

The Department of the Interior, the Territory of Alaska, and the Canadian government are collaborating in the preparation of plans for the development of an automobile highway which will extend from the boundary of the United States 2,000 miles to Fairbanks, Alaska. This road will be an extension of the Pacific highway which begins at Tia Juana, Mexico, and skirts the coast to the Canadian border. It will also tie into the park to park highways in the United States and link them with the Mt. McKinley National Park in the heart of Alaska. It will connect with the road systems of Alaska.

The School of Mines of the UNIVERSITY of MINNESOTA

By W. R. APPLEBY *

School of Mines and Metallurgy Building

Amount of metals used by a nation good criterion of its civilization—Minnesota great mineral producer and School of Mines one of oldest institutions organized to help solve its problems and furnish it engineers—Work of Mine Experiment Station

MINING and metallurgy are two of the oldest industries and the story of their development parallels the history of civilization. The amount of metals used by a nation is a good criterion of its civilization. Railroads, bridges, large buildings, ships, systems of lighting, communication, water supply, sanitation—in fact, the most vital things in the advancement of civilization, are largely dependent upon the production of the miner and the metallurgist. The outstanding position of the United States of America among the world's nations is largely due to our supremacy in the production and use of minerals.

The mining industry in Minnesota ranks second only to agriculture in importance. It is natural, therefore, that the School of Mines and Metallurgy should be one of the oldest institutions of the University.

The mining course was first adopted by the Board of Regents in 1889. The writer was appointed professor of mining and metallurgy in 1891 and regular work was offered in January, 1892. He had available one empty room and was called upon to attend to the educational needs of two students. Since that time the school has advanced rapidly in attendance and equipment. It occupies two large buildings specially designed for mining and metallurgical work and has an average attendance of 150 students per annum.

Four degrees are offered, namely, Engineer of Mines (E.M.), Engineer of Mines in Geology (E.M.Geol.), Metallurgical Engineer (Met.E.), and Petroleum Engineer (Pet.E.). All students in attendance at the School of Mines and Metallurgy are candidates for one of the above-mentioned degrees. No unclassed or special students are allowed to attend.

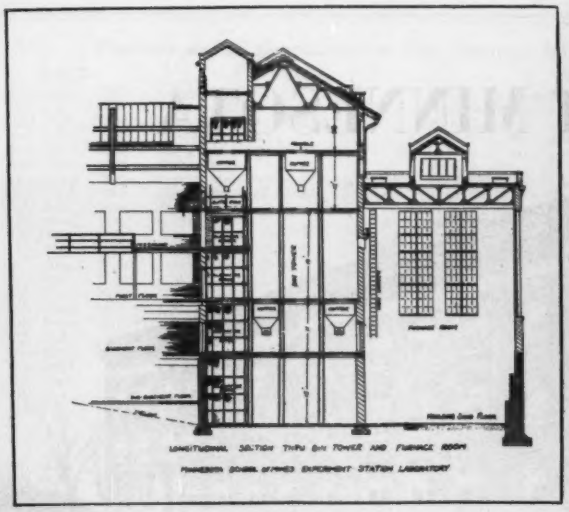
All courses are of four years' duration and few, if any, electives are offered, owing to the large number of prerequisites that are necessary to properly train the men in their respective lines. The first two years are common in all courses and provide the necessary fundamental sciences such as physics, chemistry, mathematics, drawing, etc. At the end of two years the men are well prepared to make a selection and continue to specialize during the remaining two years. The various departments are well equipped with laboratories and apparatus.

The curricula of the various courses were adopted after careful study of other similar institutions and the needs of the profession based on the experience of members of the faculty. Much discussion has been indulged in recently concerning theory and practice in educational work. The Minnesota School of Mines and Metallurgy has attempted to combine the two in such a way that the practical work will not only serve as illustrative material for the theoretical work, but also give its students a clear idea of how work is actually carried on and the changes in operations necessary in the interest of efficiency and observation.

At the end of the second year, nine weeks are spent in the field on our iron ranges. On this trip the men make a complete surface and underground survey of a mine. The men work eight hours a day and attend night classes. After completion of this work the students under the instructors in the department of geology study the geological

New mine experiment station occupied in part by the U. S. Bureau of Mines

* Dean, School of Mines, University of Minnesota.



Section through bin tower and furnace room. Construction of tower, furnace room, hoppers, elevators and their position relative to central part of building are shown

General Laboratory—Ore comes through two openings in further wall from storage bins and is fed to the various machines for treatment. Samples of ore under test are in the right background. Apparatus not in use is stored on mezzanine floor. There is also a large traveling crane, not shown

features of the Vermillion range and later make a report to the department of the results of their field work.

At the end of the junior year trips are made to the West and Southwest for the purpose of studying western mining and metallurgical practice. This course is conducted for four weeks and a detailed report is required with necessary drawings covering the localities visited, equipment used and methods employed.

Experimental iron blast furnace

Both trips are conducted by members of the staff. The students are under the jurisdiction of the School of Mines and Metallurgy and subject to the same regulations existing when in attendance at the school and pursuing their theoretical work. These trips are required of all students and credit for the work must be obtained before graduation. Each student pays his expenses on the trips in the field. The University appropriates money to cover the expenses of members of the faculty who conduct the work.

The training of School of Mines and Metallurgy students is necessarily broad, because in many instances graduates are called upon to do all the engineering work of their companies. This broad engineering training has made it possible for the School of Mines and Metallurgy graduates to successfully enter other fields of engineering work. The instruction in these various engineering courses must be fundamentally sound and the important principles thoroughly mastered. They are taught by men of experience who are familiar with the various industries. The men are well grounded in their subjects and at the same time thoroughly familiar with the prospective fields of work of their students and the demands that the profession will make upon them. The courses of study are so arranged that they will represent the application of science to the industry in harmony with the best practice of the present time.

State service and general service to the profession are important matters given consideration by the School of Mines and Metallurgy. Service to the state centers about the development and utilization of its mineral resources. The outstanding problems are the beneficiation of ores and the improvement of methods of metal production and utilization.

In 1911 the Minnesota School of Mines and Metallurgy, realizing the importance to the state as well as to the industry of giving assistance along mining and metallurgical lines, organized the Mines Experiment Station.

This station assists citizens of the state in making discoveries of new ore bodies by identifying and assaying free of charge all samples found within the state provided the exact location from which the sample was taken is given.

It also assists operators in determining the best method of treating ores that in their natural state are non-merchantable so that a good grade of finished product can be sold, shipped and smelted. As the result of a careful study of the methods of treating low-grade ores, one-third of the entire tonnage of ores shipped to lower lake ports is beneficiated product. This gives one a fair idea of the value to the state of the work done by the Experiment Station.

The staff of the School of Mines and Metallurgy is continually carrying on research work. New processes are being developed and special apparatus designed to meet requirements.

There was developed at this station a new machine which is called the magnetic log washer, capable of concentrating in a most efficient way and at a very low cost low-grade magnetite ores into an exceedingly rich and valuable product for smelting. As a result of this experimental work millions of tons of low-grade magnetite on the east end of the Mesabi range, formerly useless, are now under development and a $5,000,000 plant has been operating. When operations are resumed and normal production is reached the income that will be received by the state and the prolongation of the life of the iron ore industry will more than pay for all of the moneys expended on the School of Mines and Metallurgy and its Experiment Station since their inception.

Experiments are now being carried on with the idea of standardizing a direct process of obtaining iron from iron ores as well as manganese from the manganiferous ores of the Cuyuna range. Other materials of value to mining and metallurgical interests are being investigated.

Metallurgical microscopes

Metallographic laboratory, showing filing cabinets and equipment

In 1916 the University of Minnesota and the United States Bureau of Mines entered into a cooperative agreement whereby the Federal Bureau would establish and support one of its experiment stations on the university campus provided the university would furnish and equip a suitable building to replace the old one. Delays were encountered during the war period, and it was not until 1922 that the structure was completed. The new building is located practically on the same site on which the old one stood, and is occupied jointly by the U. S. Bureau of Mines and the School of Mines Experiment Station. It is pronounced by leading experts to be the most unique and well equipped building of its kind in the United States, if not in the world.

From the first floor plans (see illustration p. 938) of the building it will be seen that its total length is 280 ft., that it is 60 ft. wide, rectangular in form and is divided into four general sections.

The first section, as shown on the extreme left of the plans, provides for general office space on the first floor and office and laboratories in the basement.

The second section is the general laboratory. It is 139 ft. long, two stories high and is equipped with a 10-ton traveling crane. In the basement below are located the assay laboratory, sampling room and shops.

A mezzanine floor surrounds three sides of the laboratory. Two sides of this floor are used for storing apparatus when not in use, so as to make the greatest possible floor space available for operation. At the end of the laboratory nearest the bin tower the mezzanine floor is used for setting up machines which may be used in the various tests. Through the wall just above this floor can be seen two openings, through which is fed the ore from the next section or bin tower down to the machines located directly below them. The ore fed from these feeders to the machines on the mezzanine floor passes down to the machines on the floor of the main laboratory. In the middle of the main laboratory floor are three large manholes through which the ore can again be passed down to machines set in the basement. This arrangement offers three levels on which machines can be placed and permits gravity feed. The ore, therefore, can pass through three stories of machines without rehandling.

There are 12 posts (see illustration p. 938), 6 on each side, supporting the mezzanine floor. In each one of these posts are electrical outlets furnishing three phase, 220 volt, 60 cycle; single phase, 110 volt, 60 cycle; single phase, 220 volt, 60 cycle and 110-volt direct-current electric service. On the back of each of these posts are pipes furnishing high-pressure steam, low-pressure steam, high-pressure air, low-pressure air, high vacuum, low vacuum, city water and illuminating gas. Each piece of apparatus is equipped with its own motor so that the equipment on these 12 posts makes it possible to set up various machines in any part of the laboratory.

When a test has been completed, the 10-ton crane picks up the machines used in the test and places them on the storage sides of the mezzanine floor.

The third section is 35 ft. long, five stories in height—three above ground—and contains steel ore bins. The sampling, grinding and crushing equipment is located on the main floor. A 10-ton electric elevator connects all floors.

In addition to the 12 posts previously mentioned as being in the main laboratory and carrying the various service outlets, these same service stations containing outlets for electricity, gas, steam, air, etc., are located at convenient places about the building and in many of the smaller laboratories. Electric current connected to these service stations is secured primarily from the Minneapolis General Electric Company through a 4,000-volt, 3-phase transmission line. These cables enter the building in conduits placed underground and are connected to the main switchboard and transformers in a transformer room located in the subbasement. Here the high voltage is changed to 220 volt, 3 phase, 60 cycles for general motor operation, 110 volts for general lighting and 220 volt, single phase for small motor operation. Large cables carry this electricity to the main switchboard located in the basement. At this point various switches are arranged to connect these various electrical supplies to the service stations over the building.

Top floor of bin tower. If ore is wet or frozen it is dried by steam. Then it is shoveled through the manholes in floor and starts on downward journey to crusher, rolls or screens

In the subbasement, just below the main switchboard room, is located the machinery room. This room is equipped with a 500-cu. ft. capacity, 100-lb. pressure air compressor; a 500-cu. ft. capacity, 30-lb. air compressor; an 800-cu. ft. capacity, low-pressure blower; a 200-cu. ft. capacity wet vacuum pump; and a 15-kw. motor generator set for changing the 200-volt, 3-phase current to 110-volt direct current.

All of this equipment is piped and wired in the various service stations over the building and, in addition to these, gas is secured from the city mains, water from the city water mains and steam from the university heating plant. The compressors, blowers, etc., in this machinery room are all operated by remote

control, push button stations located at various convenient points over the building. When necessary, the compressors can be connected for automatic operation, thus maintaining the proper pressures on the various pipe lines.

In the main laboratory, a gauge board is located which indicates the pressure on the various air, water, gas and steam pipes and also the direct and alternating currents used when the equipment is in operation.

In the basement, a low pressure exhaust fan is located which removes the fumes from the hoods in the chemical laboratory and also the gases from some of the furnaces. This fan is also operated by remote control buttons.

In the upper floor of the office section of the building, a large steam still is located. This still is so arranged that a large storage tank is constantly kept filled with distilled water. This distilled water is piped to various points over the building and into all the laboratories through block tin pipes.

Ore bins and feeders. The ore falls into any of these six bins and by means of belt feeders can be sent to rolls, crushers or screens on floor below

The ore arriving in carload lots is placed in an electric truck and carried by the elevator to the top of the bin tower. (See illustration No. 3.) If wet or frozen it is first dried on driers, shown in the corner of the upper room. (See illustration No. 4.) When dry, the ore is shoveled through a manhole and falls into storage bins. There are six of these bins and below each of them is a belt feeder (see illustration No. 5) which is operated from the floor below. Its speed and direction is controlled from a box on the floor where the crushers, rolls and screens are located (see illustration No. 6). The operator on this floor, therefore, can feed the ore in one direction to the crusher or in the opposite direction into the rolls, or the ore can be fed from another bin by means of another feeder to a set of trommels or vibrating screens for sizing. The products from the machines on the crushing and sizing floor drop through the floor into other bins. When the ore has been worked into the desired size and condition for the test proper, it is taken up by the elevator and discharged into two large bins. From these bins the belt feeders convey it through the wall into the main laboratory to the machines for such treatment as has been determined.

Stock and grinding room

Balance room, opening into fire assay laboratory. Fire assay furnace room seen in distance

At the extreme right of the plan is the furnace room, which is 35 ft. wide and contains a blast furnace 30 ft. high. The furnace has a hearth 3 ft. in diameter and is equipped with stoves for preheating the air as carried on in actual practice. It has in fact all the essential features of a large furnace. Its daily capacity of from five to six tons of metal represents about 1 percent of the tonnage of a large commercial furnace. The furnace is constructed so that samples of gas and temperature readings can be taken easily at many points in the furnace. (See illustration No. 7.) The entire floor of the furnace room is of molding sand. The furnace was designed by Mr. T. L. Joseph, superintendent of the U. S. Bureau of Mines Station at Minneapolis, and his staff. The School of Mines built the furnace, but the furnace operations were carried on under the direction of Mr. Joseph. At the present time the Bureau of Mines and the university control the only experimental blast furnace in the country and probably the only one in existence.

Modern industrial blast furnaces produce 600 to 700 tons of pig iron daily. The raw materials, ore, coke, and limestone required to produce this amount of pig iron are necessarily large. Much creditable work has been done in the development of the modern furnace and adapting it to changes which have taken place in raw materials. However, due to the order of magnitude of the operation and the financial hazard accompanying any departure from standard or proven procedure, the development has taken place slowly and gradually.

Although Minnesota is not a large producer of pig iron, it is richly endowed with iron ore deposits, some of which contain manganese, a metal indispensable in the modern art of steel production. The development of the iron ore resources depends somewhat upon the trend in furnace development, and the proven performance of various types of ore in the blast furnace. Due to the close relation existing between the manufacture of pig iron and the production of iron ore, interest in the former as well as in the latter is obviously important to the development of state resources.

In 1919, the Bureau of Mines in cooperation with the Minnesota School of Mines Experiment Station, undertook to develop an experimental blast furnace in order to investigate, at much smaller cost than if full-sized equipment were used, various problems of vital interest to the iron industry. Blast furnace operators, accustomed to use methods based on long experience, are reluctant to use new or untried methods or materials, the peculiarities of which have not been disclosed by practical tests. Progress has been made by increasing output rather than determining accurately what happens within a furnace and applying this knowledge in the design and operation of furnaces.

The utilization of manganiferous iron ores was the first problem undertaken with this experimental furnace. Such

Heat treating room

ores occur in several districts of the United States, but Minnesota contains the most extensive deposits which have an added advantage of cheap transportation by way of the Great Lakes. At present, these ores are finding an increasing market because they aid desulphurization in the blast furnace and produce high manganese pig iron which benefits the steel making process in a number of ways. Some furnace men claim that a better quality of steel can be made from high manganese pig iron, and there is considerable evidence to support the conclusion that the amount of expensive ferromanganese needed in steel making can be decreased if high manganese pig iron is used. There seems to be little doubt that actual benefits are derived from the use of manganiferous iron ore. However, because of a very limited supply of domestic manganese reserves, the Bureau of Mines and the Minnesota School of Mines Experiment Station undertook a joint research, looking toward the most efficient utilization of these ores.

As a part of the problem, the experimental furnace was operated 34 days, during which period about 136 tons of metal were made. This material is now available for further investigating methods of obtaining a product that can be used in the manufacture of ferromanganese. This would open a new outlet for the ores, and would make this country less dependent upon imported ores and alloys which are specially important in times of war.

As a background for this experimental work, the Bureau has men in the field conducting plant research. This affords an opportunity to keep in close touch with the industry and the problems of vital interest to its development.

The general construction of the building is brick with concrete walls and steel and slate roofs. It is located near the Northern Pacific tracks, and a spur runs to the building. The building is of factory type construction, which offers the best possible lighting in the large laboratory.

The building was built and paid for by the State of Minnesota, and with its equipment represents an investment of $450,000. The building is not ornate or elaborate, but is designed for the purpose of furnishing a suitable laboratory that will not become antiquated as science advances.

In addition to the service to the state already mentioned, the Minnesota School of Mines and Metallurgy acts in the capacity of consulting engineer for the Minnesota Tax Commission. The work was begun in 1909 and has continued to date. In this capacity the school makes estimates of the tonnages and ore reserves submitted by the mining companies, checks the same and reports its findings to the Commission, which uses them for the basis of computing taxes on iron ores. The work consists of visiting and inspecting the mines, holding conferences with the mining company officials and making ore estimates on data submitted. The inspection trips are for the purpose of becoming acquainted with the operators' difficulties, the geology of ore bodies and keeping abreast of the mining industry in general. Conferences are held for the purpose of reviewing the estimates made by the engineers of the mining companies, getting their viewpoint and reasons for any deviations from current practice. Since this work was begun the School of Mines and Metallurgy has reported on practically every operating mine and ore reserve in the state. The mining companies are well satisfied with this method of procedure as they feel that well-trained engineers who are absolutely disinterested consider their special problems and report to the Commission actual findings no matter what they may be. The Tax Commission has confidence in the honesty and ability of the members of the faculty doing this work and feel that the interest of the mining companies as well as of the state are carefully protected.

One can readily appreciate the value of the state service work not only to the state, but to the students of the School of Mines and Metallurgy. While the students do not actually participate in the state service work, on account of lack of experience, still they get the benefit of the various problems that come to hand and are keenly aware of the demands that will be made on them when they enter the professional work and clear ideas as to how the various problems can be approached and solved.

Spencer says, "To prepare us for the complete living is the function of education." That the Minnesota School of Mines and Metallurgy is functioning is realized by those who call upon it and its graduates to render varied and efficient service.

METHODS AND COSTS OF MINING SOFT HEMATITE

Comprehensive information regarding practices, methods and costs in the mining of soft hematite at two mines in the Marquette and Menominee Ranges in northern Michigan are given in Information Circulars 6179 and 6180, just issued by the Bureau of Mines.

Information Circular 6179 deals with methods at a mine in the Marquette Range, which was the first iron range discovered in the Lake Superior district. The ore is a soft, hydrated hematite, generally reddish brown in color. Some of it is very high grade, but some contains silicious material to such an extent that it is classed as a silicious ore. The wider parts of the ore body are worked by radial top-slicing and the narrow parts by sublevel stoping, which is a variation of the open stope method of mining.

The Menominee Range mine described in Information Circular 6180 was discovered in 1913 by diamond-drilling, and the shaft was sunk in 1916. The operation of the mine has been rather intermittent, as the ore has not always commanded a ready market. The method of mining used has been well suited to this condition, and the stopes have not suffered during periods of idleness.

Detailed information in regard to the history and geology of the districts, the characteristics of the ores, methods of prospecting and exploration, of sampling and estimation of tonnages and values and of development and stoping methods are given in both circulars. The application of open stope mining to comparatively soft ores is of particular interest. Methods of underground transportation and mine ventilation are discussed. Accident prevention measures are outlined. Mining costs are summarized on the basis of ton of ore hoisted and in units of labor, power and supplies.

The Marquette Range mine is described in Circular 6179 and the Menominee Range mine in 6180, both papers being by Lucien Eaton, a consulting engineer of the Bureau of Mines.

The NEW MEXICO

Brown Hall

SCHOOL of MINES

New Mexico one of first states to provide instruction in mining engineering, with establishment of School of Mines in 1889—Progress accomplished in recent years illustrated by increasing number of graduates—Class room instruction augmented by field work and visits to mines—State Bureau of Mines and Mineral Resources part of institution

By E. H. WELLS *

IN the fascinating early history of New Mexico, mining occupies an important place. During the century following the discovery of America the Spanish explorers in their search for riches several times invaded the area now occupied by the state. Here they found very little of the especially coveted gold, but they did obtain some turquoise from the Indians. Undoubtedly the turquoise quarries of the Los Cerrillos Hills, near Santa Fe, were worked prior to their advent.

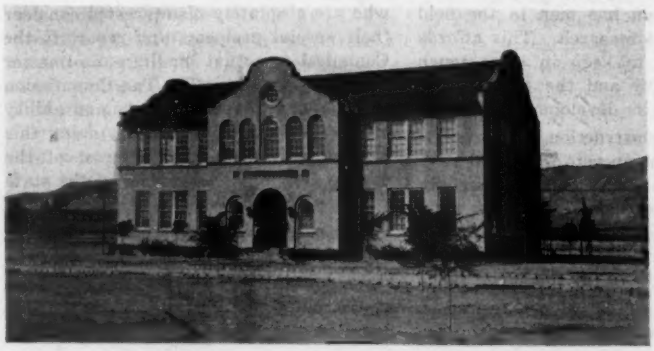
One of the first underground mining operations within the confines of the United States was begun in 1801 by the Spaniards at the great copper deposits at Santa Rita, Grant County, now in the Chino mines of the Nevada Consolidated Copper Companies. The first authentic regular placer mining west of the Mississippi River occurred in the Oritz Mountains near Santa Fe in 1828. Five years later gold ore was mined from quartz veins in these mountains.

In keeping with the early importance of her mineral wealth, New Mexico was one of the first states to provide for specialized instruction in mining engineering. In 1889 the New Mexico School of Mines was established by the territorial legislature. The construction of the old main building was begun in 1891, and it was completed the following year. The institution began its educational work in a small way in 1893 with a faculty of two men. The school year 1895-96 opened auspiciously with a faculty of five men, and complete curricula were offered in mine engineering and metallurgy.

For 10 years after its completion the main building stood alone on the campus. In 1903 the south wing of the Mining and Metallurgy Building was erected, and in 1908 Driscoll Hall, the main dormitory, was built. In 1915 and 1916 the power house was built and equipped, and the central section and north wing of the Mining and Metallurgy Building were constructed.

With the close of the World War a period of steady and continuous progress was initiated. The gymnasium was built in 1924. Science Hall, containing the departments of chemistry, physics, mathematics, and languages, was completed in 1928. The old main building was destroyed by fire in the summer of 1928. A few months later the construction of Brown Hall, the new main building, was started, and it was occupied at the beginning of the present school year. Brown Hall is 60 by 132 ft. and contains over 16,000 sq. ft. of floor space. In it are located the administrative offices, department of geology and mineralogy, department of civil engineering, library, and the State Bureau of Mines and Mineral Resources.

Inasmuch as its graduates are the chief product of the School of Mines, the institution is vitally interested in



Science Hall

* President and Director, State Bureau of Mines and Mineral Resources.

Physics Laboratory

Physics and Chemistry Lecture Room

making that product of the highest possible grade. The educational program of the school is shaped with the purpose of graduating men prepared to follow their professions with maximum profit and credit to themselves and with corresponding benefit to the industry concerned. This program not only provides for training essential to future engineers, superintendents, and executives but it also gives due consideration to proficiency in performing the tasks usually allotted to junior engineers, surveyors, assayers, draftsmen, etc.

The curricula offered include mining engineering, metallurgical engineering, geological engineering, and chemical engineering. The degrees granted upon completion of the curricula are bachelor of science in mining engineering, etc. The professional degrees of engineer of mines, metallurgical engineer, geological engineer, and chemical engineer are granted to holders of the corresponding bachelor's degrees following two years of successful professional work, during one of which a position of responsibility has been held, and upon presentation of an acceptable thesis. In addition to the above, the school confers the degree of bachelor of science without specifying any curriculum or subject. Fifteen standard high-school units are necessary for entrance, and all curricula require four years for their completion.

The credit-hour requirements at the New Mexico School of Mines are unusually heavy, ranging from 144 in the general curriculum to 159 in the geological engineering curriculum. In all curricula except the general the entire list of subjects is required. Students may, however, elect other subjects in which they are particularly interested, and nearly all students obtain extra credits in this manner. The credit-hour requirements according to the various departments are given below. The department of civil engineering offers mechanics and several mechanical engineering subjects. One lecture period a week for one semester constitutes one credit hour, and three laboratory periods a week for one semester are rated as one credit hour.

CURRICULA REQUIREMENTS

	Mining	Metallurgy	Geology	Chemistry
English	10	10	10	10
Mathematics	16	16	16	16
Physics	13	13	13	13
Chemistry	22	25	28	53
Civil engineering	35	31	22	30
Geology and mineralogy	27	21	50	13
Mining	17	16	17	6
Metallurgy	15	21	9	9
Physical training	2	2	2	2
Total credit hours	157	156	159	152

The progress accomplished at the New Mexico School of Mines in recent years is well illustrated by the growth of the graduating class. From 1896, when the first degree was conferred, until 1922, inclusive, 40 men graduated from the school, an average of less than two per year. From 1923 to 1929, inclusive, 109 degrees were conferred, the average being 15 and a fraction per year. It is worthy of special note that 90 percent of the graduates of the school are holding positions for which their college work was a direct preparation.

The cost of attending the New Mexico School of (*Continued on page* 946)

Part of Experimental Ore Dressing Plant showing rolls, ball mills and jig

Part of Freshman Chemistry Laboratory

School of Mineral Industries

OHIO STATE UNIVERSITY

School embraces Departments of Ceramics, Metallurgy, Mineralogy, and Mine Engineering—Ceramics course first of its kind in world—Exceptional research facilities afforded—Miners' vocational night schools conducted in mining centers of Ohio

By H. E. NOLD *

THE public-school system of the State of Ohio apexes in the Ohio State University at Columbus, Ohio. The university embraces 10 colleges and a graduate school. The property of the university consists of over 1,000 acres of land, with more than 70 buildings, and represents a total investment by the state of nearly $20,000,000.

The total enrollment for the school year 1928-29 was 13,657 students. At present the College of Engineering has an enrollment of 1,634 students. Within the College of Engineering there is the School of Mineral Industries, with a present enrollment of 171 second, third, and fourth year students. First-year students are not differentiated from the other freshmen engineers.

The School of Mineral Industries of the Ohio State University was formed two years ago when the School of Mines was given a new name, which more nearly describes the service the school renders to the State of Ohio. The original law establishing a School of Mines at the Ohio State University provided for studying, scientifically and experimentally, the various phases of mine engineering, including the opening and operating of mines, the analysis and testing of minerals, and instruction in the uses and preparation of the minerals for use. Specifically mentioned in this law are coal, ores, fireclay, oils, gases, and other minerals.

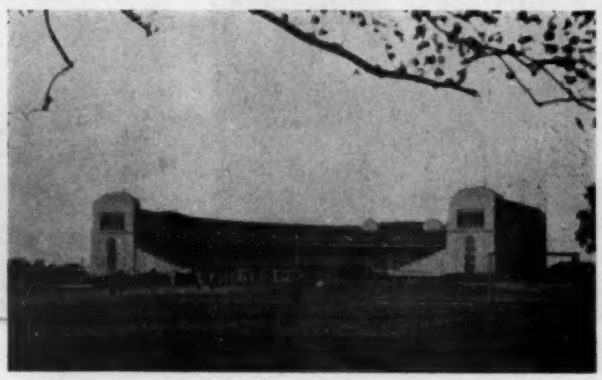
Out of and within the "School of Mines," established by law, have grown the departments of ceramics, metallurgy, mineralogy, and mine engineering. These same departments now form the School of Mineral Industries.

This school serves, in an educational way, the entire mineral industry of Ohio, which, based on the money value to the producer, amounts to over three-quarters of a billion dollars annually. This is divided about as follows:

Mining (including open-pit mines, underground mines, petroleum and natural gas)	$86,000,000
Ceramic industries (heavy clay products, pottery, glass and enamels)	115,200,000
Pig iron, steel, and ferro alloys	514,000,000
By-product coke	34,700,000
Lime and Portland cement	23,800,000

Four four-year curriculae leading to appropriate degrees are offered in the school. These are: Mine engineering, petroleum engineering, metallurgical engineering, ceramic engineering.

The work in the school is so staffed and organized and the relations with other departments and colleges of the university are such that students can elect additional advanced work in mine engineering, petroleum engineering, geology, ore dressing and coal cleaning, mineral technology, fuel technology, iron and steel technology, ceramic engineer-



The Stadium

* Professor of Mine Engineering, School of Mineral Industries, Ohio State University.

Orton Hall, housing Geological Department, Geological Museum and Geological Library

Engineering Experiment Building

ing and ceramic technology, including heavy clay products, whiteware, glass, glazes, and enameling. Students also have the privilege of electing both cultural and professional work in the various colleges of the university.

Curriculae

Recognizing mathematics, physics, chemistry, and mechanics as the fundamentals of all engineering, each of the curriculae offered in the School of Mineral Industries stresses these subjects.

The curriculum in *Mine Engineering* is arranged with the object of allowing the students to acquire a thorough as well as broad gage education in the fundamentals of mine engineering. The work is not classified as metal mining, coal mining, etc. Care is being taken to avoid training men for a job or for jobs in a rather narrow field. The graduates distribute themselves about equally between metal mining and nonmetallic mining.

The curriculum in *Petroleum Engineering* is arranged to give the students an opportunity to get a thorough fundamental training in petroleum mining, exploration, and transportation. To do this the main blackbone of the mining curriculum has been retained with considerable metallurgy and some mining being replaced by geology and petroleum engineering. No effort is made to take up petroleum refining.

The curriculum in *Metallurgical Engineering* is not a part of nor is it closely akin to mine engineering. The metallurgical engineer in the eastern United States is not closely associated with mines in his work. This curriculum offers the men an opportunity for a good fundamental engineering training and at the same time gives them the opportuity to acquire a good understanding of both ferrous and nonferrous metallurgical technology or fuel technology.

The *Ceramic Engineering* curriculum, like metallurgy, offers a thorough training in the fundamentals of engineering and in addition offers fundamental training in heavy clay products, refractory, whiteware, glass, glaze, and enamel technology. This school is the father of ceramic education, as previously noted, offering the first course of its kind in the world.

Research Facilities

The school affords exceptional research facilities for advanced undergraduates, graduate students, and faculty. These facilities include, among others, the laboratories of the school in Lord Hall; the laboratories of the Engineering Experiment (see photograph this page) Station of the College of Engineering; the laboratories of the Columbus Station of the U. S. Bureau of Standards (also housed in Lord Hall); the exceptionally well-equipped heavy clay experimental plant at Roseville, Ohio, where tests can be carried through the laboratory and tested out in a full-sized manufacturing plant and a number of manufacturing plants and mines in Ohio. Four fellowships, three in ceramics and

Lord Hall, headquarters of the School of Mineral Industries

Robinson Laboratory, housing Mechanical and Electrical Laboratories

one in solid fuels, each with a stipend of $750 for 10 months, are allotted each year.

The members of the faculty, individually and as faculty members, keep in close touch with the various mineral industries of Ohio. The students benefit by this in having a faculty familiar with the needs and developments of industry, by supervised visits to industrial plants and mines, and by receiving aid to find jobs in which to get their required summer industrial experience.

Vocational Night Schools

As a part of the school activities and as an aid to miners and the mining industry, miners' vocational night schools are conducted in the mining centers of Ohio. There are at present 10 schools in as many centers, with a total enrollment of over 400. The students in these classes include miners, section bosses, mine foremen, fire bosses, superintendents, and even a few general managers.

The work, although distinctly vocational, is fundamentally educational and is intended to help the mining man answer the question "Why?" and to make him a better and more careful miner. So far nothing beyond a two-year course of work has been attempted, but the gratifying interest of the men in the classes and requests for more advanced work has seemed to justify the offering of a third year's work which is accordingly now being prepared for classes next year.

MINE ENGINEERING

First Year

Common to all Engineering Freshmen

Subject	Credit hours per week: Autumn quarter	Winter quarter	Spring quarter	Summer quarter
Mathematics	5	5	5	
Chemistry	5	5	5	
Engineering drawing	4	4	4	
English	3	3	3	
Military science, physical education, etc.	4	3	3	
Second Year				
Mathematics	5	5	..	
Mechanics	..	..	5	
Physics	5	5	5	
Surveying	5	..	4	
Metallurgy	3	4	..	
Mineralogy	..	3	3	
Military science	1	1	1	
Inspection trip	..	..	..	10 days
Industrial work	..	..	..	10 weeks
Third Year				
Mechanics	5	5	..	
Geology	5	3	..	
Ore dressing	5	..	..	
Metallurgy	3	..	..	
Mining	..	5	3	
Electrical engineering	..	5	3	
Structural engineering	..	..	5	
Engineering drawing	..	..	3	
Mineralogy	..	..	3	
Fourth Year				
Mechanical engineering	5	3	..	
Mining	5	5	5	
Geology	5	..	..	
Metallurgy	2	3	5	
Mine plant design	..	5	5 or 0	
Microscopic petrography	..	..	0 or 4	
Elective	..	3	3	

PETROLEUM ENGINEERING

First Year

Same as Mine Engineering

Second Year

Subject	Credit hours per week: Autumn quarter	Winter quarter	Spring quarter	Summer quarter
Mathematics	5	5	..	
Mechanics	..	..	5	
Physics	5	5	5	
Geology	5	3	..	
Mineralogy	3	3	..	
Surveying	..	..	5	
Metallurgy	..	3	..	
Engineering drawing	..	..	3	
Industrial work	..	..	..	10 weeks
Third Year				
Mechanics	..	5	3	
Ore dressing	5	..	..	
Metallurgy	5	..	..	
Geology	3	3	5	
Mineralogy	..	3	..	
Surveying	..	..	4	
Mining	..	5	3	
Elective	5	3	..	
Fourth Year				
Mining	5	..	..	
Petroleum engineering	3	3	3	
Plant design	..	5	..	
Mechanical engineering	5	3	..	
Geology	5	..	..	
Electrical engineering	..	5	3	
English	..	3	..	
Microscopic petrography	..	..	4	
Elective	..	..	3	

THE NEW MEXICO SCHOOL OF MINES

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Mines is very nominal. Tuition is $20 a year for residents of New Mexico and $50 a year for non-residents. The average cost of fees, books, and other school supplies is $65 per year. Board and room at the dormitories is from $34 to $37 per month. The total average cost of attendance, exclusive of traveling expenses, amusements, clothing, and other personal expenses is $365 a year for residents and $395 for non-residents.

Located at Socorro, the New Mexico School of Mines is unusually fortunate in its environment. The surrounding country is rich in examples of geological types, structures, and processes. Mine workings at Socorro Mountain, 2 miles from the school, are available for instruction in mine surveying. Modern practice in the mining and milling of zinc-lead ores and the geology of the deposits are illustrated in the Magdalena district, 25 miles away, and coal mining and geology can be observed in the nearby Carthage district. The many available concrete illustrations of the subject matter of the courses are utilized as frequently as possible. The local environment and the dry, mild climate of Socorro permit practically all field work to be conducted during the regular school year, thus avoiding the necessity of special summer classes for this purpose.

The annual senior trip takes the students to the chief places of interest in southern New Mexico. Among the properties visited are the Chino mines of the Nevada Consolidated Copper Company, at Santa Rita, and the Chino mill, at Hurley; the Tyrone copper mines and mill, of the Phelps Dodge Corporation; the iron mines of the Hanover Bessemer Iron & Copper Company, at Fierro; and the mines and mill of the Empire Zinc Company, at Hanover. Other deposits of the itinerary are the manganiferous iron deposits and the silver deposits near Silver City, the Lake Valley silver deposits, and the deposits of gold, lead, and vanadium near Hillsboro. The senior trip also includes the Carlsbad Cavern and the old fields of southeastern New Mexico and the smelters and other metallurgical plants at El Paso, Tex.

The importance to the student of practical experience in the field for which he is preparing is recognized by the school, and all undergraduates are urged to spend one or more summers as miners, trammers, timbermen's helpers, mill operators, surveyors' helpers, etc. The contacts established in this manner are frequently of great value in obtaining permanent employment following graduation.

The New Mexico School of Mines has a State Bureau of Mines and Mineral Resources as a (*Continued on page 949*)

The MINING INDUSTRY of IDAHO

By STEWART CAMPBELL *

Winter transportation in Central Valley County.

The vast supply of undeveloped mineral resources within the state assures her mineral future—Mining closely woven into the history of the state—Lead, silver, gold, zinc and copper principal minerals—Non-metallics important factor in future

THE HISTORY of Idaho starts with the discovery of gold in the placer mines of the Pierce City district, Clearwater County, in 1860. The overflow from the stampede to Pierce City resulted in the discovery of the Elk City placer mines about 1862. These rich placers attracted much attention, and in a short time the region was swarming with placer miners; the discovery of other rich districts—Florence, Warrens, Lemhi County, Boise Basin, and Silver City—followed within the next two years and led to the formation of the Territory of Idaho. Many of these placer mines were soon exhausted, and the early prospectors then turned their attention to lode mining. Numerous rich discoveries were made, and for many years Idaho depended entirely upon mining for its means of livelihood. Thus we have the indisputable fact that the state owes its existence to mining.

In the past practically all mining has been confined to the five principal metals —lead, silver, gold, zinc, and copper. These metals are widely distributed throughout the state, but there is also a great variety of uncommon metals and minerals. It is this diversity of mineral wealth that makes Idaho one of the principal mining states in the Union.

NON-METALLIC MINERALS

The greatest known non-metallic mineral resources within the state are the immense phosphate rock deposits located in southeastern Idaho. Conservative estimates made by the U. S. Geological Survey accredit this section of the state with 6,000,000 tons of minable rock, a tonnage that exceeds 85 percent of the total available supply of the world.

The Anaconda Copper Mining Company, one of the largest mining organizations in the world, is pioneering in the development of the phosphate industry. This company's mine and mill plant, situated in Caribou County near Soda Springs, is one of the largest of its kind in the United States. Over $2,000,000 has been expended on this enterprise, and production is being maintained at the rate of 250 tons per day.

Limestone is mined in Butte, Bonner, Clearwater, and Teton Counties; Bannock and Blaine Counties also contain deposits of importance.

Coal of commercial importance occurs and is being developed in Teton County.

An industry of importance is that of the Boise Stone Company at Boise in quarrying Idaho sandstone. This stone is exceptionally well adapted to building purposes and has been used in many buildings in Idaho and throughout the United States, the most notable one being the Idaho State Capitol.

Barytes, asbestos, diatomaceous earth, mica, pyrites, and salt also occur in the state in commercial quantities.

METALS

The mining and exploitation of the five principal metals—lead, silver, gold, zinc, and copper—constitute the second most important industry in Idaho, and make it one of the principal mining states in the Union. The total production of these metals and the importance of Idaho's mineral industry is well shown by the following:

Total metal production since 1860, over $1,100,000,000.

Average annual production for past 25 years, over $25,500,000.

Average annual mine pay roll, over $9,000,000.

Average annual mine dividends from lead-silver mines, over $5,000,000.

Average annual expenditure on new mine development and prospecting, over $4,000,000.

Lead

Lead is the most important metal found in Idaho, and excepting in the years 1926 and 1927 this state has always ranked second in the United States in the production of lead, Missouri ranking first, and Utah third. During the two years aforementioned Utah held second place, although the production of the two states was almost on a parity. Idaho produces over one-fourth of the total amount of lead mined in the United States. Lead is widely distributed throughout the state, and occurs as galena (lead sulphide) and as the oxide and carbonate; silver is always associated with it, and occasionally zinc, gold, and copper.

The largest lead mine in the United

* State Inspector of Mines.

Hercules Mining Company's mill at Wallace.

States is in Idaho—the Bunker Hill & Sullivan Mining & Concentrating Company at Kellogg, Shoshone County. This is one of the few companies in the world that mine, mill, smelt, refine, manufacture, and market lead and lead products. Other important lead-producing mines in Idaho and their respective ranks in the United States are: Federal Mining and Smelting Company, third; Hecla Mining Company, fifth.

The principal lead mines in the state are those in Shoshone County, which produce 85 percent of the state total. Blaine, Boundary, Bonner, Custer, Lemhi, Boise, Butte, Valley, and Camas Counties are the other important lead-producing counties.

Silver

Idaho ranks third in the United States in the production of silver, the first three states in order being Utah, Montana, Idaho. Idaho produces one-eighth of all the silver mined in the United States.

Silver is found associated with all of the lead, copper, zinc, and antimony ores of the state, and occasionally in associations in which it is the principal metal. It is one of the most widely distributed metals, and its occurrence is such that the mining of silver can hardly be separated from that of the other metals. Accordingly, the production of silver fluctuates with and parallels that of lead.

Shoshone County produces more silver than any other county in the state; the other important silver-producing counties are Lemhi, Custer, Bonner, Boundary, Blaine, Butte, Owyhee, Boise, Camas, Valley, Washington, Idaho, Elmore, Adams, and Cassia.

Zinc

Zinc is found associated with lead in many of the lead mines of Idaho, although there are numerous deposits in Shoshone and Blaine Counties in which it is the principal metal. In Shoshone County it occurs as sphalerite (zinc sulphide), and in Blaine County as sphalerite and smithsonite (zinc carbonate).

Selective flotation revolutionized the art of ore dressing, and it is now possible to treat mixed lead-zinc ores which could not be separated by gravity concentration methods. As a consequence, the zinc content which was formerly lost is recovered and many mines which at one time could not be profitably operated are now being reopened in Blaine, Camas, and Shoshone Counties. As a result of these modern ore-dressing methods, Idaho is one of the largest zinc-producing states in the Union and is the home of one of the most modern zinc-reducing plants—the electrolytic zinc plant of the Sullivan Mining Company at Kellogg, Shoshone County, owned jointly by the Bunker Hill & Sullivan Mining & Concentrating Company and the Hecla Mining Company. Its product is the highest grade zinc metal produced in the world and sells at a premium over other brands of zinc.

The principal zinc-producing counties, in the order of prominence, are Shoshone, Blaine, Camas, Custer, Lemhi, Bonner, Boise, Boundary, and Butte.

Gold

Gold is found in practically all of the counties in the state, and is one of the most widely distributed metals. Prior to the World War Idaho was an important producer of this metal, but during the war period many of the mines of which the principal product was gold were closed down and have not been reopened, so at the present time the state ranks only tenth in the United States in gold production.

Gold occurs associated with almost all the lead, zinc, copper, and silver ores, and very commonly in a free-milling condition. A large amount of gold is obtained from placer deposits; at one time Idaho was among the principal placer-mining states in the Union. The greater part of the placer ground which could be hydraulicked has been exhausted, but many acres suitable for dredging still remain, and the gold lode deposits offer greater opportunities than those of almost any other state.

The most important counties in which

Close-up of a Blaine County barite deposit.

Placer mining in Lemhi County.

Spudding in an oil well 30 miles east of Idaho Falls.

Sullivan Mining Company's electrolytic zinc plant at Kellogg.

gold occurs are Boise, Idaho, Lemhi, Owyhee, Elmore, Shoshone, Custer, Blaine, Camas, Clearwater, Gem, and Valley.

Copper

Idaho is an important producer of copper and holds a high position among the ranking states of the Union. The many copper mines which are now under development and the numerous discovered but undeveloped veins indicate that the production of this metal will be greatly increased; the state will then be elevated to a rank higher than that of tenth, which it now holds.

Gold and silver are found associated with practically all the copper ores; and in some counties, notably in Custer and Bonner, the silver content is more valuable than the copper.

Custer, Lemhi, and Shoshone are the most important copper-producing counties; Adams and Washington Counties may eventually become large producers. Bonner, Idaho, Blaine, Butte, Clearwater, Latah, and Lewis Counties also contain copper mines of importance.

Miscellaneous Metals

Other metals of commercial importance which occur in Idaho are: Antimony, arsenic, bismuth, cobalt, manganese, molybdenum, nickel, quicksilver, and tungsten. During the World War the antimony and tungsten deposits were worked and a large tonnage was marketed, but, except for a small amount of development work on the quicksilver and manganese deposits, none of these metals is now being exploited. However, their development is fully warranted, for some are the largest undeveloped deposits in the United States, especially those of molybdenum.

FUTURE

Idaho's undeveloped mineral resources exceed those of any state in the Union, particularly for the development of new lead, silver, gold, copper, zinc, and molybdenum mines. These metals are found in practically every county of the state that has any mineral resources and, as world conditions are such that their development will eventually follow, it is safe to assume that the outlook for the future prosperity of mining in Idaho is exceedingly bright and that the state is assured of a growing instead of a declining industry.

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department of the institution. This bureau was established by the 1927 legislature for the primary purpose of assisting the development of the mineral resources of the state. The work of the bureau consists mainly of (a) the preparation and publication of reports dealing with New Mexico geology and mineral resources, (b) the collection of a library and bibliography of literature on New Mexico geology, mines and minerals, and (c) the compilation and publication of data pertaining to the mineral industry of the state. The staff includes a director, who also serves as president of the faculty; three geologists, two of whom devote half of their time to instructional work in the department of geology and mineralogy; and a librarian and statistician. Several advanced students are given part-time employment in the bureau. Laboratory and other facilities of the school are utilized in the bureau work, the institution being thus enabled to be of direct service to the mineral industry of the state.

The accomplishments of the State Bureau of Mines and Mineral Resources have been greatly restricted as a result of the loss of all records, and much of the work done to date in the fire which destroyed the main building in 1928. One bulletin, entitled "Fluorspar in New Mexico," has been issued, and several others are in preparation. The chief present undertaking is an investigation of the ore deposits of Socorro County, with special emphasis on the Magdalena district.

MEASUREMENTS OF EARTH RESISTIVITY

The value of ground resistivity measurements made on the surface of the earth as an index of structure below it is gradually becoming of increasing importance, according to the United States Bureau of Mines. While originally of direct interest to the mining engineer in the location of ore deposits, it has found further applications in the location of various electrical resistivities. The functioning of power service and telephonic communications are more or less affected by the position of the various earth's resistivities relative to each other. The location of proper bridge, dam and building foundations with the aid of resistivity measurements is today an accepted procedure.

Although the procedure of measurement is relatively simple, interpretation of the results involves a large amount of study. Because of the great variety of discontinuities which embrace the ground structures, involving both a change of dimension as well as electrical properties, no simple mathematical system of analysis can be applied directly to these measurements. A new mathematical tool must be invented to meet these needs, hence the results must rest for the present upon extensive experimental work rather than possible theoretical deductions. Some of the difficulties encountered are set forth in Information Circular 6171, by Frederick W. Lee, J. W. Joyce, and Phil Boyer.

For purposes of measurement two systems of determining the average resistivity of the earth are used. Their difference rests upon the type of boundary surface between which the material is located whose average resistivity is to be measured.

A detailed description of both systems of determining earth resistivity is given in Information Circular 6171, which may be obtained from the United States Bureau of Mines, Washington, D. C.

Developing the NON-METALLIC Industries of the West

The West amply provided with fuels—Great resources of refractories, paving and building materials summarized — Ceramic clays, salts, sulphur and many other non-metallics abundant—Natural resources for diversified industry available

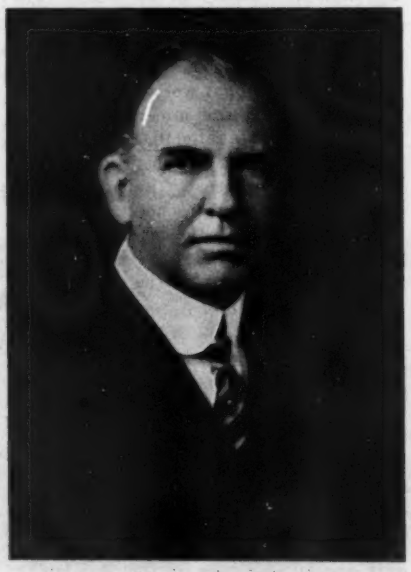
By WALTER W. BRADLEY*

THE mineral industries, not only in California but throughout the country, have reached quite a different phase from that of the old gold-rush days of more than 50 years ago. A broader and more intimate status has been attained touching practically every avenue of domestic and commercial endeavor. Of the freight handled by the railroads of the country, the products of the mines represent 51.33 percent of the total tonnage. While gold, in which California still leads the United States, is still important in several of the western metal-mining states, other metals and even nonmetals have superseded it in annual value. The greatest commercial developments proportionately in California in recent years have taken place among the industrial and structural minerals, not to mention petroleum, which leads all others in value. This introduces another factor which requires study and attention—that of marketing. This involves also preparation of the material, standardization, specifications, as well as selling the product. The gold miner could, and still does, take his metal to the mint and receives its equivalent in the "coin of the realm"; and he knows from day to day and year to year, without variation, just how much each ounce of gold will bring in that coin, though its equivalent in other commodities varies according to economic conditions. Marketing and the attendant competition, however, are vital factors in the industrial and structural groups.

With increasing population on the Pacific coast there is a gradual but sure growth in the number and character of industrial plants, established and operating, particularly in California. Quite a few nationally-known concerns have built, and others are now building, factory branches here to supply the coast markets. Such plants are also in a more favorable position to command a share of the oriental trade. If I appear to overemphasize California's resources and her economic position, I am sure the representatives of our neighboring Pacific coast states will appreciate that it is because I am better acquainted with her resources through personal contact. Such information and data as are given herein relating to other western states have been largely gleaned from official reports and literature of the Federal bureaus and the several states. I shall not attempt to include all of the "West," if by that term is meant all west of the Mississippi River; but what might more specifically be designated as the Pacific coast states or those west of the Rocky Mountains; namely, Alaska, Washington, Oregon, Idaho, California, Nevada, Arizona, and Utah. That, of itself, takes in considerable territory. Nor will it be possible within the limits of the time and space available to me for this paper to go very far into details of the various mineral products considered, because the list is quite an imposing one, comprising so far as California alone is concerned some 35 or more of the non-metallics only.

FUELS

Fuels, the most valuable commercially today of which is, of course, petroleum, play an important part in the industrial life of the Pacific coast alike for power as well as for other purposes. In this resource California is the well-known leader, for she supplies not only her own territory with fuel, lubricating oils, and other derivatives of crude petroleum but large quantities of both crude and refined products are shipped to near-by and distant neighbors. The proximity of large supplies of petroleum products (likewise its attendant natural gas) at low comparative cost is a pertinent item for consideration in the location of many industrial establishments. California crude oils are all essentially of asphalt base, with a few notable exceptions, and specific gravities range from 8° Baumé in the Casmalia field, Santa Barbara County, to 60° in the Kettleman Hills field, Kings County.



Walter W. Bradley

Natural gas is also abundant in California in those districts in and adjacent to the oil fields, and in addition is piped distances up to 200 miles to certain industrial centers, notably the Los Angeles area and more recently the San Francisco Bay region. "Wet" natural gas in the oil fields is the source of considerable quantities of high-gravity gasoline, which is recovered by compression or by absorption, according to the type of plant employed. For some classes of industrial plants, natural gas is preferable for fuel to either oil or gas. There is a small production of petroleum and natural gas in Alaska, and of petroleum in Utah.

So far as California is concerned, coal has been superseded as a fuel by petroleum and natural gas, except for lesser tonnages of imported coal from Utah, Wyoming, and Washington utilized for domestic purposes. Even manufactured domestic-service gas is obtained from crude oil. Utah and Washington are the important coal-producing states of this Pacific coast group. Alaska has large potential coal resources, though as yet only relatively small tonnages are shipped. Both Utah and Washington ship considerable coke, which is a valuable and necessary requirement in metallurgical work.

STRUCTURAL MATERIALS

The Pacific coast is well supplied with structural materials. Practically any type or style of structure is possible with the wealth of local materials available. Deposits of granite, marble, and other building stones in great variety of colors and texture are widely distributed

* State Mineralogist of California, Ferry Bldg., San Francisco, Calif.

throughout this territory. Although some of these deposits are as yet at considerable distances from cheap transportation facilities, yet the resource is a potential one, and will some day become economic when population and the demand call for it. As the designation indicates, the mineral substances grouped under this heading are those directly employed in building and structural work. Some of these commercial minerals classed as "industrial" are more or less utilized in "structural" applications, but they have other uses as well.

Asphalt and Bitumen

The native bitumens or asphalts, including gilsonite, elaterite, and the mineral wax, ozocerite, are mined in important quantities in Utah. They are especially valuable as constituents in paints, waterproofing, and insulating compounds, baked enamels for auto-body finishing, and in the manufacture of rubber products, including automobile tires.

In the earlier days of the oil industry in California, considerable quantities of natural asphalt were mined from outcroppings of oil sands. For some years now, however, nearly all of the asphalt has come from oil refinery residuum, as that source yields a more uniform and better product. Such natural asphalt as is at present mined in California is in the form of bituminous "rock" or sandstone, utilized for road surfacing in those districts adjacent to available deposits.

Brick and Hollow Building Blocks or Tile

Bricks of many varieties and in important quantities are annually produced in California, there being clays available and suitable for practically any type of product desired. Not only do the plants supply practically all of our own requirements in these products but considerable quantities are shipped to contiguous territory and certain varieties are sent out over a much wider radius. Hollow building blocks or tile being employed in part in the same role as bricks are included in this grouping. Their use has been growing in popularity in recent years, not only in commercial structures but also in dwellings. While California dominates the clay-products picture on the coast, Washington and Utah also are annually making valuable contributions from their resources, and Oregon to a lesser degree.

Cement and Concrete (Including Crushed Rock, Sand, and Gravel)

Today's extensive program of concrete road building, and the construction of great monolithic dams for hydroelectric and irrigation plants, such for instance as the proposed Boulder Canyon Dam, on the Colorado River in Arizona, to say nothing of reinforced concrete structures of all sizes and types, would be out of the question without Portland cement, which in turn requires the broken stone and sand to complete the aggregate. Cement today in California has attained to a position second only to petroleum in point of annual value of its output. It is now more than double the annual value of our gold yield. There are 12 plants, with a total annual output in excess of 14,000,000 barrels. Oregon, Washington, and Utah also have plants in operation and supply the markets within their own radii.

Chromite

Chromite is widely distributed in California, and in 1918 a total of 29 counties contributed to the state's war-time output. During the same period important shipments were made from southwestern Oregon and some also from Washington. Since the lapse from the high prices of the World War period, the chromite industry has languished here, because of higher transportation costs which we must pay to put the ore into the eastern steel mills in competition with the imported foreign material. There are ample supplies for such markets as may be developed locally on the Pacific coast.

Granite

Though California is far in the lead among the coast states as a commercial producer of granite, Arizona, Oregon, Idaho, Washington are also important sources, with lesser amounts annually coming from Nevada and Utah. For building purposes, the granites found in California, particularly the varieties from Raymond, in Madera County; Rocklin, in Placer County; and near Porterville, in Tulare County, are unexcelled by any similar stone found elsewhere. The quantities available, notably at Raymond and Porterville, are unlimited. Granites of excellent quality of color and grain for both building and ornamental purposes are also quarried in a number of other counties.

Lime

Limestone is widely distributed throughout California, and apparently is also available in commercial deposits in all of the Pacific coast states, as all except Alaska annually report production in greater or less amounts. Alaska ships marble, so it, too, has the raw material. There are a number of plants which calcine the rock, producing lime which is utilized for structural purposes. Practically any economic specifications can be met as to quality and quantity.

Magnesite

Washington and California are the only commercial contributors of magnesite in the United States thus far. The occurrence of this mineral has been noted in Nevada, and it might be expected in the serpentine areas of southwestern Oregon, but none has been developed. The Washington and California magnesites are quite different, both in character of the mineral itself and the associations of the occurrences. Most of the California magnesite is comparatively pure and is ordinarily a beautiful, white, fine-grained rock with a conchoidal fracture resembling a break in porcelain. The most important deposits thus far developed are segregations in or alterations from serpentine, though there are at least two sedimentary deposits. The magnesite of the Washington deposits is fairly coarsely crystalline, resembling dolomite and some crystalline limestones in physical appearance. It occurs interbedded with dolomitic limestone, and its color varies through light to dark gray, and pink. It contains a small percentage of iron, making it particularly suitable for refractory purposes, while the California magnesite is most suitable for plastic uses.

Marble

California and Alaska are both commercial producers of marble, and smaller amounts are contributed by Arizona, Utah, and Washington. Alaska has one advantage in transportation in that the marble deposits being worked are at tidewater and the blocks of stone can be loaded directly onto seagoing vessels. The principal variety is white, with more or less black veining. Marble is widely distributed in California, and in a considerable range of color and grain. Many beautiful and serviceable varieties occur, which are suitable for almost any conceivable purpose of construction or decoration. These also include onyx marble and travertine of beautiful coloring and effects, and serpentine marble suitable for electrical switchboards.

Sandstone

Important amounts of sandstone are quarried annually in Washington, Oregon, Idaho, and California, with some also in Utah and Arizona. The Californian stone is mostly gray, buff, or yellow in color. The popularity of lighter-colored building stones and other finishes, such as architectural terra cotta, has curtailed sandstone production here during recent years.

Slate

California has available supplies of black and gray slate that compare favorably for roofing purposes with those products found elsewhere, and though quiescent for a number of years, there are prospects of it again being on the market soon. Utah has deposits of green and purple slates from which commercial shipments are made. Slates with serviceable possibilities have also been noted from Nevada and Arizona, but are as yet undeveloped.

INDUSTRIAL MATERIALS

The substances designated as "industrial" numerically form quite an imposing total, although none of them has attained to the magnitude in annual values shown by gold, copper, or cement, for example, or even by coal in Utah and Washington. Many of these substances are mineral earths, or they are minerals that have specific industrial applications. Marketing becomes a more vital part of the problem when handling this type of product than with metallic ores. In some cases rigid trade specifications must be adhered to as to quality and composition. Most of our "industrial" minerals have been largely dependent upon the local and Pacific coast markets, which are restricted by our limited population and fewer industrial plants than the markets for similar ores in the more populous eastern states. For

this reason development has not attained to the importance in many of these substances that it doubtless will some day, or of which our resources are capable.

Asbestos

Arizona leads the United States in annual production of asbestos, not only in quantity but in length of fibre of her chrysotile variety and consequent value. Smaller amounts are contributed by California and Idaho, but the total for all three is small in comparison with the Canadian output. Part of the Californian material is amphibole. The future of asbestos mining in California and the other western states is dependent largely upon the development of uses in quantity for the short-fibre mill grades, and for the amphibole variety. Large resources of such material can apparently be made available.

Barytes

About two-thirds of the total tonnage of barytes utilized in the United States is taken in the manufacture of lithopone. The principal sources are Missouri, Georgia, and Tennessee, but commercial amounts are also contributed by California, Arizona, and Nevada. Two plants in California are preparing lithopone or other barium chemicals. One of the newer uses of barite or "heavy spar," as it is sometimes called, is to increase the specific gravity of the heavy mud employed in oil-well drilling operations to hold down gas pressure.

Clay (Including Also Other Aluminum Silicates Used in the Ceramic Industries)

In this designation "pottery clay" refers to all clays used in the manufacture of red and brown earthenware, china and sanitary ware, flower pots, floor, faience and ornamental tiling, architectural terra cotta, sewer pipe, drain and roof tile, etc. It does not include clay used in making brick and hollow building blocks which are listed under the structural grouping. There are many other important uses for clays besides pottery manufacture, among which may be enumerated paper, cotton goods, and chemicals. Clays of the montmorillonite (bentonite or "rock soap") group are being utilzed successfully in the manufacture of soaps.

California leads the coast group in the annual volume and value of her clay products, but Washington, Utah, and Oregon are also important contributors. Idaho, Arizona, and Nevada join the list in a smaller way.

Diatomaceous Earth or Diatomite

The two major uses for diatomite are for filtration and for insulation, the latter both in heating and refrigeration units. It also has important uses as an absorbent and for polishing purposes. Diatomaceous earth is a very light and extremely porous chalk-like material composed of pure silica (chalk being calcareous) which has been laid down under water and consists of the remains of microscopical plants called diatoms. Over 8,000 species of diatoms have been identified, over half of which number have been fossilized, and of which several hundred at least have been identified as occurring in deposits in our Pacific coast states. Commercially not all are equally suitable for specific purposes. The large circular marine diatoms found notably in Santa Barbara County, and some also in Monterey County, Calif., have been found to be especially efficient for filtration purposes, and then mainly in those portions of the deposits where they have been undisturbed and there is a minimum of broken skeletons. For practically all other purposes, however, most of the other species serve well, with variations here and there. About 75 percent of the diatomite shipments in the United States come from Santa Barbara County, Calif. Smaller amounts are shipped from Monterey, Los Angeles, and Shasta Counties, and from the states of Nevada, Oregon, and Washington.

Dolomite

Since dolomite, as such, has been found to have distinctive applications, we have for a number of years in California been listing it separately in our mineral resources reports; but in the reports of other states and the Federal bureaus it is still included with the limestone data. An important part of the tonnage of dolomite in California is utilized as a refractory lining in the bottoms of open-hearth steel furnaces, as a substitute for magnesite. Calcined dolomite is also used by paper mills, replacing an artificial mixture of calcined limestone and magnesite in the sulphite process of manufacture of paper from wood pulp. The paper mills of Washington and Oregon should provide a market for a considerable tonnage of dolomite, if not already doing so.

Feldspar

Feldspar, which is so important to the ceramic industries, is supplied to coast plants largely from quarries in San Diego and Riverside Counties, Calif., and some also from near Kingman, Ariz.

Fluorspar

Fluorspar, of such great value as a flux in the metallurgy of steel and of aluminum, is apparently not at present being produced commercially by any of the Pacific coast group of states, though small tonnages have in the past come from deposits in Arizona, California, Nevada, Utah, and Washington.

Fuller's Earth

Production of fuller's earth is reported from California and Nevada, and is utilized principally in the refining of crude petroleum. Most of the Californian material so used, however, consists of clays of the montmorillonite or bentonite class rather than the true fuller's earth. The practical test of a "fuller's earth" is, after all, not so much a chemical as a physical one; that is, its physical capacity to absorb basic colors and to remove these colors from solution in animal, vegetable, or mineral oils, also from water. Utah reports production under the designation "mineral soap."

Gems and Jewelers' Materials

Quite a number of varieties of gems and jewelers' materials have been produced with more or less irregularity of annual amounts and values in nearly all of the western states, but no data appear in recent reports of the U. S. Bureau of Mines, as they have discontinued the annual canvass for such figures. California's principal gem yield is of tourmalines and quartz, and includes also diamonds, garnets, kunzite, beryl, chalcedony, californite or California jade, topaz, rhodonite, chrysoprase, turquoise, lapis lazuli, jasper, opal. Arizona has produced turquoise; Oregon, agate, bloodstone, and opal; Utah, jasper; Washington, chalcedony.

Graphite

Graphite has been produced from time to time in California, but not as yet in large amounts. A small output is also reported from Nevada. The Nevadan mineral is the amorphous variety, and the Californian, crystalline.

Gypsum

Nevada and California are the two principal western producers of gypsum, with the former considerably in the lead, the important deposits being in Lincoln and Lyon Counties. California's principal sources are Imperial, Riverside, Kern and San Bernardino Counties. Some gypsum also is produced in Arizona, Oregon, Utah, and Alaska. That from Alaska is shipped crude to Tacoma, Wash., where it is calcined.

The most important use of gypsum from the quantity standpoint is in the calcined form, where it is utilized in the manufacture of various hard-wall plasters and plaster board. The use of gypsum tile and precast units for nonbearing fireproof partitions, stairways, and elevator enclosures, and the protection of steel columns, girders, and beams, has increased greatly. The Portland cement industry is, of course, an important customer for gypsum, 2 percent by weight being added to the cement clinker just before the final grinding.

Limestone

Limestone has many industrial uses. Under this heading we include the stone used as a smelter and foundry flux, for glass and sugar making and other special chemical and manufacturing processes. It also includes that used for fertilizers, roofing gravel, concrete filler, whiting for putty, paint, kalsomine and rubber filler, facing dust for concrete pipe, and a host of others. Calcareous marl sold for agricultural purposes is likewise classified under this designation. The quality of the material quarried varies widely with the analysis demanded by the requirements of the specific use for which it is intended. With some, color also is important. For example, for paint and kalsomine it must be white. In other cases the structure (crystallization and grain) is essential.

From the annual quantity and value standpoint, Utah, California, and Washington are the important producers of

the Pacific coast group, in the order named. Smaller quantities are reported from each of the others, except Alaska. Limestone is of widespread occurrence in most of these states, as it is in California, but commercial development is dependent principally upon the economic factor of convenience to cheap transportation, as well as upon chemical analysis and size of deposit.

Mineral Water

A widespread commercial production of mineral water is shown annually in California, amounting to more than a million dollars in value. Of the other coast states, Oregon, Nevada, and Washington report small amounts. The figures published refer to mineral water actually bottled for sale or consumption, and both table and medicinal waters are included. From a therapeutic standpoint, California is particularly rich in mineral springs. Radio-activity has been noted in at least three localities, and doubtless exists at others. The waters of some of the hot springs are not suitable for drinking, but are very efficacious for bathing.

Phosphates

Idaho is the only state of the Pacific coast group which produces phosphate rock, and it is there an important resource. Some shipments have in the past been made from Utah, but not recently. There have been some occurrences of phosphates noted in California, but as yet no economic development has resulted. It is apparently too low in grade.

Pyrites

Pyrites form an important resource in California for the manufacture of sulphuric acid, but none of the others of this group so report, except that Arizona lists sulphuric acid as a by-product from copper smelting. As a matter of fact, considerable quantities of sulphuric acid are annually made from the waste gases at both copper and zinc smelters in various parts of the United States. That and the large production at low price of native sulphur in Texas and Louisiana has materially reduced the consumption of pyrite for acid-making purposes.

Soapstone and Talc

The widest use of talc is in the powdered form, and the value depends upon color (whiteness), uniformity, fineness of grain, freedom from grit, "slip," and sometimes freedom from lime. Nearly 80 percent of the product in California at present is high-grade talc, mainly from Inyo and San Bernardino Counties, with some also from Shasta, and is utilized mostly in toilet powders, paints, paper, and rubber manufacture, some also in ceramics and for polishing rice. The "soapstone" grades are being used mainly for roofing granules and as a filler in roofing paper, and part also in magnesite cement mixtures. None of the other western states report either talc or soapstone.

Sulphur

Native sulphur is being produced commercially on a moderate scale from a deposit in Humboldt County, Nev. Deposits of native sulphur have been noted at a number of localities in California, but thus far production has been small and irregular. It is difficult for these western deposits to compete with the enormous and cheaply-mined resources of Texas and Louisiana in this element, which are now supplying the important world markets.

Other Lesser Industrial Minerals

Without taking time nor space to go into the details of their occurrences or their utilization, the following minerals may be here listed as among the resources of the Pacific coast group; but they are "lesser" only in the sense that individually the annual value of the output has been or is as yet relatively small: Lithium minerals in California; mica in Nevada and Idaho; mineral paint pigments in California; pyrite crystals in Arizona and galena crystals in California, for radio detectors; pumice (both block and ash) in California, Arizona, and Oregon; pulpstones and rubbing stones in Washington; shale oil in California, Utah, and Nevada; silica (quartz and sand) in California, Nevada, and Washington; strontium in California.

Salines

The salines, in which are included the borates, common salt, potash, soda, magnesium chloride and sulphate, calcium chloride, and bromine, form a very important group industrially of raw mineral products among the Pacific coast states.

In the borates, California leads, but is joined by Nevada. In the seventies and eighties production came from the "playa" or dry lake beds of both these states, but in 1887 the industry was revolutionized by the discovery and development of colemanite (calcium borate) beds in San Bernardino County and later at Death Valley, Inyo County, and in Los Angeles. A few years ago similar beds were developed in Clark County, Nev. Colemanite has now been supplanted by the discovery, three years ago, of a new sodium borate mineral, kernite (or "rasorite," as it is also known) at Kramer, in Kern County, Calif. This mineral has only six molecules of water of crystallization as against 10 molecules in the "borax" of commerce; with the result that in its conversion (by simply dissolving in water and recrystallizing) to borax, nearly 1½ tons of the commercial product are obtained for each 1 ton of crude mineral.

Common salt is an important item in California's commercial list, as well as in Utah. In the former, it is obtained mainly by solar evaporation of the Pacific Ocean water, and in the latter from the water of Great Salt Lake. Nevada and Idaho also report small amounts of salt annually. It may appear at first thought superfluous to enumerate the uses of so well-known an item as "common salt," one whose history antedates the written page, but it is employed for many purposes other than culinary. Its uses include such industrial lines as packing meat, curing fish and hides, dairying, refrigeration, preserving products from deterioration, pottery glazing, enameling, pickle making, salting live stock, and in some chemical industries, as in preparing soda ash and caustic soda.

Potash is an important item in California's list, one plant alone at Searles Lake accounting for approximately 75 percent of the domestic output in the United States, or nearly $2,000,000 value in 1927. Utah is also a contributor. The principal consumption is as a fertilizer and in fertilizer mixtures; but there are also important chemical uses. The United States produces, however, only about 10 percent of her domestic requirements for potash salts, the main dependence being on German and French importations.

Sodium compounds to some extent replace potassium compounds in glass and soap making, in photography, match making, tanning, and in the manufacture of cyanide for extracting gold and silver from their ores. The dense ash and the bicarbonate are important in the soap, glass, and chemical industries; the salt cake (sulphate), in paper making; and the natural trona for metallurgical purposes. Commercial production in California includes all of the above, joined by Arizona, Nevada, and Washington, with the natural sulphate.

In addition to the above salines, California also provides bromine and magnesium salts from salt-works bittern waters, and calcium chloride as a by-product in the refining of salt from certain of the desert dry lakes. Occurrences of the nitrates of sodium, potassium, and calcium have been noted in the desert regions, but no deposit of commercial consequence has as yet been developed.

SUMMARY

As evidenced by the foregoing, which is necessarily sketchy and hardly more than touches the high lights because of the widespread and varied resources covered and the meagre time herein available, these states of the Pacific coast group are "well heeled," in the terms of the vernacular, so far as raw mineral resources are concerned, and particularly as regards the nonmetallic ores. Almost any possible line of industry desiring to locate in our midst can be supplied from one or another source within this territory. There are also advantages of climate, hydro-electric power, and ocean transportation.

The TAXATION of Mines

By A. P. RAMSTEDT*

Administrative problems in determining mine depletion reviewed and feasibility of percentage depletion based on net income discussed—Belief expressed that Congress will work out a fair solution—Mine taxation in Idaho outlined.

A FEDERAL TAX PROBLEM

THE application of the income tax to the industries of wasting assets presents some very difficult problems, and the application to mines some special problems, of which the most perplexing is undoubtedly the question of mine depletion.

The principle of depletion as a deduction from income has been recognized in all of our Federal income tax laws, and the principle of discovery depletion has been recognized specifically since 1918, and was indirectly recognized in the act of 1913 in that the taxpayer was allowed to deduct from income 5 percent of the gross value of the output at the mine.

The 5 percent deduction was simple but inadequate. Therefore, in 1916 the allowance was changed to a reasonable amount, not to exceed the market value at the mine of the product mined, limited to cost or March 1, 1913, value.

The act of 1916, in effect, eliminated depletion on discoveries made after 1913, and therefore in the act of 1918 it was provided that depletion be allowed on the basis of cost, March 1, 1913, value, or the value of discoveries after February, 1913.

It was thought at the time that the depletion provision of the 1918 act was broad enough to cover ore bodies developed after 1913, or later date of acquisition, which had not been included in any prior valuation, but it was soon found that under the narrow interpretation of the statute by the Internal Revenue Bureau no allowance could be had for the depletion of a newly discovered ore body unless a new mine was by the discovery added to the mine or mines already known to exist.

The discovery provision was changed in the 1921 act so as to limit the deduction to the net income before depletion, and in the 1924 act to 50 percent of the net income before depletion.

An attempt to extend the discovery provision to cover extensions of known ore bodies not included in a prior valuation failed in the passage of the 1926 act, but under a more liberal interpretation of that act discovery depletion has been allowed in cases where taxpayers have been able to show so-called interrupted extensions of continuing commercial veins or deposits.

Ever since the enactment of the revenue act of 1918 and the promulgation of the Treasury regulations under that act relating to mine, oil, and gas discovery depletion it has been felt that sooner or later we would have to get away from the method employed in computing the depletion allowance by substituting something simple and equitable. The method employed is what is known as the analytical appraisal method, which has been condemned as a practical scheme in this connection by everyone, as far as I know, who has given the subject much study, including such experts as Dr. T. S. Adams, Dr. L. C. Graton, and Mr. J. C. Dick, all having had experience in the practical application of the method in determining depletion allowances.

In the case of oil and gas discoveries the method was abandoned in the act of 1926 by substituting therefor a percentage of gross income allowance.

While a percentage of gross income may be the practical percentage basis in the case of oil and gas, I have felt for many years that the net income basis as a substitute for discovery depletion was the practical and best solution of the problem for mines. All of the mine operators of Idaho, as far as I know, favor the net income plan, as do many operators and experts outside of Idaho.

On arriving at Washington in the fall of 1927 to urge the net income plan, we found that the Division of Investigation of the Joint Committee on Internal Revenue Taxation was making a study of a percentage of gross income plan, and it appeared that the engineers of the division would be able to submit something practical in time to be incorporated in the new law. The plan which was finally brought forth provided for an allowance in the case of metal mines of 15 percent of the gross income, limited to 50 percent of the net income, or an allowance on the present basis of March 1, 1913, value, cost, or value of discovery made prior to the enactment of the new law.

On account of the limited time it was simply impossible to get out the data necessary to support a net income percentage plan as a substitute for discovery depletion, past, present, and fu-

* Controller, Hercules Mining Company, Wallace, Idaho. Presented to the meeting of the Western Division of the American Mining Congress, Spokane, Wash., October 1, 1929.

ture. Therefore, in an effort to secure some reasonably fair method by which the present discrimination between mine taxpayers might be removed, the industry got behind the proposal.

While I firmly believed that the net income percentage plan as a substitute for discovery depletion was the simpler plan, I supported the gross income scheme because of the urgent demand of my people for immediate relief. I justify my support of the proposal to retain established past discoveries by the fact that in many cases such discoveries, after great expense, had been established of such magnitude as to become the basis for financing; i. e., the issue of stocks and bonds, occupying very much the same position as March 1, 1913, value or cost. As to basing the percentage on gross income, I felt that the major objections were met by the 50 percent net limitation. The plan was a combination of the gross and the net income plan. However, the objections of the Treasury were so pronounced that the scheme was finally abandoned and the provisions of the 1926 act were carried into the act of 1928.

As far as I can see, the percentage of net income plan meets all of the objections raised to the gross income plan. It establishes a definite relationship between the value of the mineral in place in the ground and the figures on which the percentage is to be applied; it is so simple that any taxpayer should be able to compute the allowance without having to employ a staff of experts and going through extended hearings before the commissioner, appeal board, or courts in order to settle honest differences of opinion and, most important of all, it will make for equity as among taxpayers.

In view of the recognition of mine depletion as a deduction from gross income in all of our income tax laws, I think we may properly assume it to be an established principle in our Federal income tax scheme. However, some question has been raised as to the justification for discovery depletion which is not raised as to depletion on the basis of cost or March 1, 1913, value, although discovery depletion has been specifically recognized in all of our income tax laws since and including the act of 1918.

Mining is the wasting of a natural resource, and nothing short of discovery depletion in some form will reimburse a mine owner, even roughly, for the exhaustion of his mineral. It is the mineral in the ground, discovered and owned by the taxpayer, that is depleted, and while the depletion allowance has sometimes been looked upon as a recompense for the extraordinary hazard of bringing capital of this peculiar character into existence (and it may be justified on that theory alone), it is, as a matter of fact, a return of the taxpayer's capital; very much as the value of a gift at the time of acquisition is recognized as a return of capital in accounting for the proceeds from the later sale thereof.

Mr. Justice Brandeis, in U. S. *v.* Ludy, No. 289, decided May 16, 1927, after referring to the fact that the corporation tax law of 1909 had failed to provide for any deduction on account of the depletion of mineral reserves, says: "The resulting hardship to operators of mines induced Congress to make provision in the revenue law of 1913 and all later acts for some deduction on account of depletion in determining the amount of the taxable income from mines." In the same opinion this able justice says:

"The fact that the reserve is hidden from sight presents difficulties in making an estimate of the amount of the deposits. The actual quantity can rarely be measured. It must be approximated. And because the quantity originally in the reserve is not actually known the percentage of the whole withdrawn in any year, and hence the approximate depletion charge, is necessarily a rough estimate. But Congress concluded, in the light of experience, that it was better to act upon a rough estimate than to ignore the fact of depletion."

While the suit referred to was brought under the revenue act of 1916, as amended by the revenue act of 1917, what has been said by Justice Brandeis as to the depletion principle, the rough estimate of the depletion allowance, and the difficulty of estimating hidden ore reserves may well be carefully considered in the study of discovery depletion, and especially what method shall be adopted to arrive at a reasonably fair allowance. So much for the principle of discovery depletion.

Assuming now that the principle of depletion as applied to new discoveries as well as to known mineral deposits is justified, no fair man will contend that there is any equity in allowing discovery to one taxpayer whose ore deposit happens to be interrupted by an unexpected fault or by some barren ground, and denying discovery to another taxpayer because his ore deposit happens to be continuous without any interruption. The difficulties that confronted the oil and gas industry prior to 1925 confronts the metal-mining industry today. It appears that in the case of oil and gas wells these difficulties were made so apparent to Congress that in the act of 1926 it substituted for the valuation method a flat deduction of 27½ percent of the gross income from the property, but not to exceed 50 percent of the net income from the property computed without the allowance for depletion, and not to be less than if computed on cost or March 1, 1913, value. Oil and gas wells are not in a class requiring radically different treatment, and no fair man will contend that there is any equity in allowing this percentage depletion to the oil and gas industry and not allowing any depletion whatever to a very substantial portion of the mining industry. The thing is simply unconscionable, and I firmly believe that the condition which the present law has brought about was never intended by Congress. I recognize the earnest desire of the Commissioner of Internal Revenue and the Secretary of the Treasury to do exact justice in every case, but I know that that is practically impossible under the present law.

I believe there is no serious opposition to percentage depletion from the Senate Finance Committee, the House Ways and Means Committee, the Joint Committee on Internal Revenue Taxation, the Investigating Section of said joint committee, the Treasury Department, and the mining industry, but our experience has inclined us to believe that opposition to percentage depletion has been stimulated by a comparatively few professional tax experts and engineers in and out of the Bureau of Internal Revenue whose material for work is supplied by the necessity of taxpayers for expert assistance, the retrospective valuation of ore reserves, and the continuous reopening of mine cases thought by taxpayers to be settled.

The present law does not give all taxpayers who have exhausted their original bases an allowance for depletion, although in fairness they are entitled thereto. The ore body developed by the taxpayer after 1913, or later date of acquisition, not known on said date to exist or not expected to be encountered, is a discovery as a matter of fact whether such discovery is the interrupted or uninterrupted extension of a continuing commercial vein or deposit. To say that discovery depends upon whether the vein is interrupted by an unknown interruption is absurd. In all fairness, we should not continue denial of relief from the present unfair statute to the taxpayers who are urgently in need of this allowance in the development of new ore bodies and small properties about to reach the production stage.

Speaking from my knowledge of the Coeur d'Alene District, it is my firm belief that any simple and reasonable allowance based on net income will stimulate development and probably increase the aggregate taxable income from this source, and I do not see why the same conditions should not obtain in other fields.

Many of our mining companies have

been carrying on for years, paying big taxes to the Government on fictitious income, but not distributing one cent to stockholders as dividends. It seems to me that we all must know that the present law is unfair, and while there may be some who, not being struck directly by the unfairness, are afraid to say anything about it for fear that allowances which they are now enjoying may be attacked and lost. Is there any reason why the industry as a whole can not get actively behind a proposal fair to everyone? A law as unfair and discriminatory as the present law is can not survive long. If this discrimination continues something is going to happen. Either those who are now enjoying preferential treatment, however secure they may feel in their position, will be brought down to the level of the others, possibly by denying discovery depletion to all, or substantially all will be given a reasonable and fair allowance.

We who are so vitally interested in this question are pleased to know that the Joint Congressional Committee is continuing its study of this subject. The plan which I have outlined here is either right or wrong. If it is wrong we don't want it. If a better plan can be devised, that is, of course, what we will all want, and we still have faith in Congress to work out a satisfactory solution if the matter can be fully and properly presented, and we have faith in the ability and fairness in the industry to do that.

A State Tax Problem

Passing now to some of our local tax problems, we have in Idaho a mine tax law which I believe to be correct in principle.

The surface of mining claims is assessed at the price paid the Government therefor, machinery, equipment, and all improvements are assessed at the value thereof, and the total of net profits of the preceding year is taken as an additional value against which the general property tax levy is extended.

This law has been on our books, unchanged, for more than 25 years and has proved generally satisfactory to the mining industry and to all other industries located in mining counties, and therefore directly and materially interested on account of local taxes.

However, other tax problems confront us of general interest under the present organization of society, and I desire to discuss these problems from the standpoint of our industries generally and not the mining industry alone.

In Idaho the property tax is our chief source of revenue for state, county, city, and district purposes. The assessment of all property, except the operating property of certain public utilities assessed by the state board of equalization, is made by elected county assessors. The county assessment is reviewed by the board of county commissioners sitting as a county board of equalization, which board also levies the ad valorem tax for county purposes. The state board of equalization, consisting of the governor, secretary of state, attorney general, state auditor, and state treasurer, equalizes the assessment throughout the state by classes and determines the amount of state ad valorem tax which each county must pay to the state by apportioning the total state ad valorem tax among the several counties on the basis of assessed valuation. In the absence of adequate general supervision, the tendency in the local assessment is to reduce the assessed valuation in each county in order that the county may profit thereby in the apportionment of the state tax, with the result that, aside from the unequal distribution of the tax, we have about reached the limit as far as taxing the property which does not now escape assessment entirely.

It appears that we have reached a stage where something has to be done to encourage the assessment of property which is now escaping assessment and to distribute the tax on the people who should pay, thereby indirectly reducing the present burden on land and to some extent relieving the unsatisfactory agricultural situation brought on by changed conditions since the World War.

The present tax situation brings out all sorts of "half-baked" tax schemes of more or less merit. For example, at the last session of the Idaho legislature there was proposed for passage an equalization tax bill providing for the imposition of a tax for state purposes upon natural persons, copartnerships, associations, and corporations, to be measured by or according to the net income of the taxpayer, but from which there might be deducted state and county taxes paid by the taxpayer during the income year. The alleged purpose of the act was to reduce the tax on property to the extent of the revenue produced by the proposed law.

It is my opinion that the proposed act, if enacted into law, would have been impossible of fair administration by any bureau the state could possibly afford to set up for that purpose, and, aside from the question of its constitutionality, would have been a failure as a revenue producer in a state like Idaho.

The bill failed to pass, but the fact remains that there should be some reduction of the tax burden on property, mainly real property, and especially farm lands.

The general property tax will have to be our chief source of revenue for county, town, and other local purposes, and I believe, therefore, that the first step in attempting to remedy the trouble is to eliminate the state levy from the general property tax scheme and thereby do away with the necessity to equalize between counties. I think that full cash value assessment is desirable, if not necessary, for proper equalization. That kind of an assessment is practically impossible when local tax officials feel that they must lower the assessment of their county or run the risk of being "soaked" in the apportionment of the state tax. They feel it to be their duty to get the valuation down as far as possible, and that leads to greater inequality and failure to assess much property that can be reached.

I have made a study of a retail sales tax as a source of state revenue and offer that plan as a possible practical means for separation of state and local revenue.

This plan contemplates a tax of a percentum (say, 1 percentum or a percentum which might be fixed annually by the state board of equalization) of the gross sales of all goods, wares, and merchandise sold at retail (for final consumption and use) within the state, or, if sold outside the state, brought into the state and distributed therein, the intent being to tax the last sale in all cases where such sale can be taxed without running afoul of the Federal Constitution and statutes.

I believe that the meaning of the phrase "goods, ware, and merchandise" as employed in this connection is free from ambiguity or doubt, whether used in the popular or legal sense; that it includes only those articles which are sold or kept for sale by a merchant or dealer, and does not include property and produce sold by a farmer, the product of mines, forest products, etc. The selling of material or supplies to retail merchants, manufacturers, and jobbers, or the selling of personal or public services, insurance, and similar items does not constitute the business of the ordinary dealer, and such items would not, I think, be included in "goods, wares, and merchandise" as used here.

The phrase might be extended to cover the sale of meals and similar items, in which event the sale to the restaurant or other establishment should not be taxed.

The phrase might be extended to cover the sale of electric energy, water, transportation, and telephone and telegraph service, but it is my opinion that all state-regulated public utilities should be excluded from the application of this tax plan.

The phrase would not, without extension, include equipment and supplies used in the construction of reservoirs or canals to convey water to the place of beneficial use, or used in the develop-

ment of the material resources of the state, as for example mine timber and machinery, logging equipment, etc. Idaho is a state of partially developed vast natural resources, and while the main end of their development is private gain, a great benefit to the people at large results indirectly and incidentally from such development, and the sale of equipment and supplies so used could consistently be left out.

We do not have exact information as to the total amount of retail sales, but a rough estimate would indicate that a tax of 1 percentum on the sales at retail of all kinds of goods, wares, and merchandise, without extending the items of sale to embrace real property and raw materials, or to include receipts for public or private services, amusements, etc., would produce revenue which, added to what is now received from sources other than property taxes, would be sufficient for all state purposes. The actual figures necessary for an accurate determination of the rate will have to be compiled after we have satisfied ourselves that the plan is all right in principle. We are fortunate in that we have the machinery to levy an ad valorem state tax in August in event the sales tax should prove inadequate.

The tax, being on the last regular sale, could be administered with accuracy and small expense without imposing any burden on the taxpayer in determining his tax liability. There is really nothing else quite so simple about a business as its sales, which would be reported monthly on blanks provided for that purpose with remittance of the tax due.

The tax, not being dependent on profit, would be certain as a revenue producer. There could be very little, if any, evasion, and the taxes paid would reach the state without deduction for collection expense.

In accordance with ordinary business practice, the tax would become an item of cost, and as such passed on the consumer with other costs in the price of goods, being distributed over articles which would bear it in the same way as other items of cost are now distributed.

The tax would lighten the burden on industry in that it would distribute the state tax generally on all the people. This general distribution would necessarily operate to reduce the amount to be paid by those who now carry the entire load, and in the case of the established local merchant who seldom, if ever, escapes his full share of property tax, it should not operate to increase the price of goods, while in the case of the powerful chain store some increase may result; but even in that case the low rate would not be sufficient to appreciably increase the price of goods. Speaking of chain stores—we have them in practically every town. They carry only a few days supply of stock on hand; do an enormous business, comparatively, but pay practically no tax as compared with the competing established individual stores. The retail sales tax as applied to the chain stores offers a substantial new source of state revenue.

In conclusion let me say that the purpose of this proposal is not to tax business but to distribute the tax burden more generally on all the people according to their ability to pay. That is the purpose of the income tax, but that purpose can be more nearly accomplished in a state like Idaho by a retail sales tax than by an income tax.

BUREAU OF MINES WORK REVIEWED IN ANNUAL REPORT

The training of more than 81,000 men employed in the mineral industries in first-aid or mine-rescue methods was a feature of the educational campaign conducted by the United States Bureau of Mines during the fiscal year ended June 30, 1929, in the endeavor to bring about safer and more healthful working conditions among mining, quarrying, metallurgical, and oil and gas workers, states Scott Turner, Director of the Bureau, in his annual report to the Secretary of Commerce. The number of these workers trained in the past fiscal year surpassed by more than 30,000 that attained in any previous year, and brings the total number so trained by the Bureau since its establishment to approximately 365,000.

As about half of the approximately 2,600 fatal accidents that occur annually are caused by falls of mine roof and coal, an intensive study of methods of reducing the number of deaths from this cause was conducted. The trend toward mechanization is resulting in a large increase in the number of types of mechanical mining equipment submitted to the Bureau for testing, and the Bureau's list of "permissible" electrical equipment, approved after thorough tests, now covers every activity for which such equipment is used underground. An increasingly large proportion of "permissible" explosives are being used as a result of the Bureau's investigative work.

A significant step toward the solution of the economic problems of the mining industry has been taken in the preparation of numerous special reports of mining and milling methods and costs at representative mine operations. Increasing attention was given during the year to mineral prospecting by geophysical methods. Subsidence of the surface in various mining districts has been studied and helpful recommendations made.

In the field of metallurgy, the Bureau continued the development and improvement of methods for recovering more of the mineral content of ores, with attendant lessening of the cost of recovery. The Bureau has been able to render effective service in the improvement of methods for the treatment of the complex or low-grade ores.

Valuable fundamental data on the smelting of iron ores are being obtained. Progress was made in the effort to develop methods for the profitable recovery of the manganese content of the low-grade manganiferous iron ores of northern Minnesota and for the beneficiation of various types of low-grade manganese ores.

Research was continued looking to the more efficient mining, treatment, and utilization of the numerous important non-metallic minerals. Special attention was given to the problems affecting the phosphate, bauxite, kaolin, and ocher industries. In the effort to discover commercial potash supplies core drilling in the salt beds of New Mexico and Texas was actively continued.

In addition to studying the scientific and technical problems of the mineral industries, the bureau is giving increased attention to economic conditions and problems.

The Sources of GOLD SUPPLY*

By ROBERT H. RIDGWAY †

United States at present ranks second in gold output, producing eleven percent of world total—Our production has decreased over fifty-six percent since 1915—An outline of the world situation

THE production of gold has been an exceedingly important factor in the economic development of civilization. From earliest times man has treasured gold so highly that the possession of territories producing it has been the cause of endless strife. The first output of this metal antedates the Christian era by many centuries and its use as an ornament goes back as far as we have record. At an early date it found general use as a measure of value and as a medium of exchange. Desire for its possession has always served as a potent incentive not only to conquest but also to exploration and ultimate settlement of previously undeveloped areas. The present system of finance is based on the gold standard and its continuance depends in some degree upon maintenance of the gold supply.

Gold is widely distributed, but not abundantly. Although it is known to all men and was mined to some extent by early man, production in large amounts became possible only through the advent of modern machinery, processes and organization. It is found in the oldest rocks and in nearly all succeeding geological formations. Easily worked alluvial deposits have long been a source of this metal, and considerable quantities are known to have been produced from them by the ancients, though no statistical records of such production exist and there is no definite basis for its estimation. Even in relatively modern times there has been considerable production from regions where records were not kept; probably much clandestine production has occurred in order to avoid confiscation, royalties or even taxation.

Since the discovery of America, 1493 to 1927, inclusive, world production of gold has been approximately 1,003,500,000 ounces. The salient features of this production are shown in Table I.

TABLE I.—SALIENT FEATURES OF WORLD PRODUCTION OF GOLD

Period	Years	Quantity (fine ounces)
1493-1927	435	1,003,563,329
1493-1901	409	499,982,060
1902-1927	26	503,581,269
1493-1800	318	113,023,226
1801-1850	50	38,035,687
1493-1850	358	151,058,913
1851-1875	25	154,053,785
1876-1900	25	182,177,135
1851-1900	50	336,230,920
1493-1900	408	487,289,833
1901-1925	25	477,526,621
1926	1	19,349,118
1927	1	19,397,757
1901-1927	27	516,273,496

These 435 years have included three notable periods of production—the first, the year immediately following the discovery of the new world; the second, the third quarter of the nineteenth century; and the third, the quarter century preceding the World War.

The era of gold production that followed the discovery of America was almost certainly the greatest the world had witnessed up to that time, as the exploitation of mines by slave labor and the looting of palaces, temples, and graves in Central and South America resulted in an influx of gold that unbalanced the economic structure of Europe and even disturbed its political control.

During the second period of intensive gold production, the quarter century following 1850, more gold was produced in the world than in the 358 years immediately preceding, chiefly because of the discoveries of gold in California and Australia, whose placers proved to be only the forerunners of numerous rich lode mines and finally of low-grade dredging operations. In the third era, the 25 years that culminated with an enormous peak production of 22,718,154 ounces in 1915, discoveries of gold on the Rand and in Alaska, the Yukon Territory, Nevada and Colorado, coupled with the development of the cyanide process, resulted in production that surpassed any previously known or likely to occur in the future. On the Rand there was revealed the greatest concentration of gold thus far discovered; but, as much of the Rand ore is low-grade, the Cyanide process suitable for such ores proved an important factor in rendering available

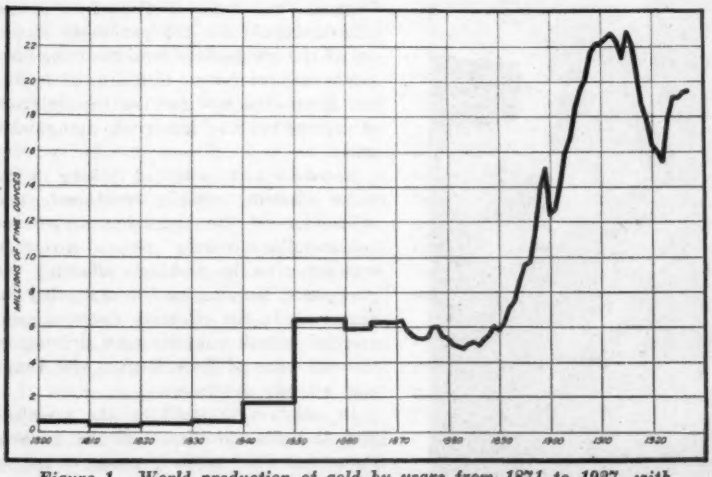


Figure 1. World production of gold by years from 1871 to 1927, with 5-year annual averages from 1851 to 1870 and 10-year annual averages from 1801 to 1850

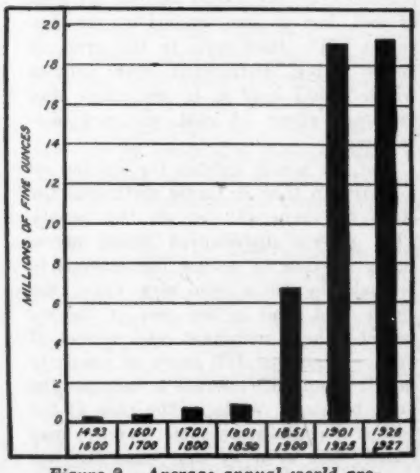


Figure 2. Average annual world production of gold for various periods

* This paper is based upon detailed tabulation contained in U. S. Bureau of Mines Economic Paper 6, "Summarized Data of Gold Production," by Robert H. Ridgway.
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† Mining Engineer, Common Metals Division, U. S. Bureau of Mines.

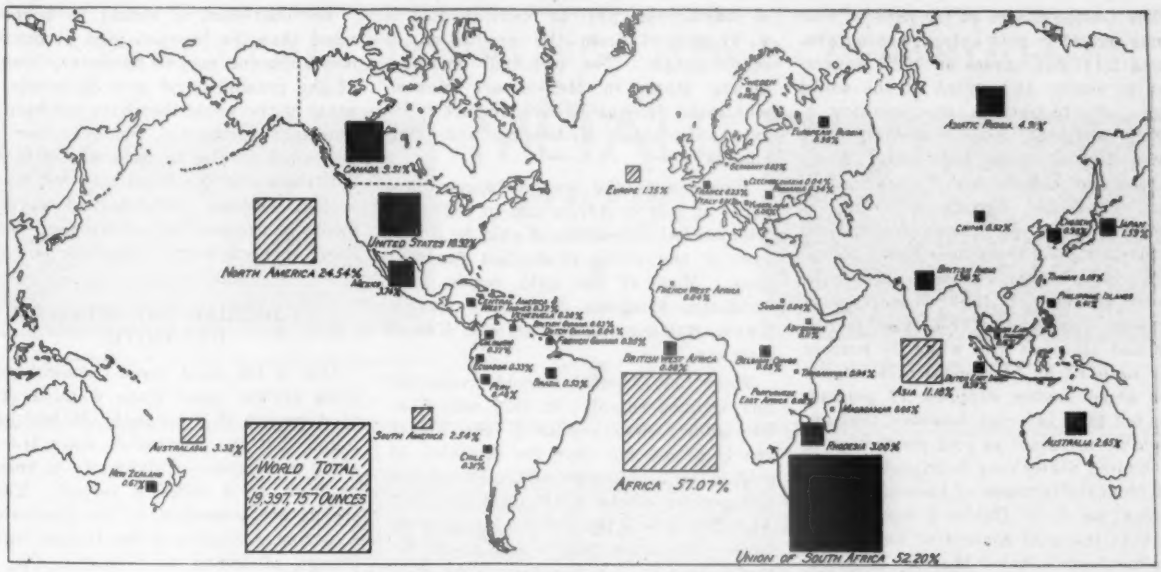


Figure 3. Geographical distribution of world gold production in 1927

the gold of the South African bankets. The trend of world gold production since 1800 is shown graphically in *Figure 1*.

In considering the production of base metals over periods, it was found that the production was based on the demands of an increased population which civilization had brought to a fuller realization of the utility of those metals. Accordingly, except for some recessions due to abnormal economic and political conditions, the base metals have shown decided increases throughout the periods studied.*

The production of base metals thus depends more on demand than supply. With gold, however, history has shown that no superabundance was ever attainable. The great bonanzas of the past have been susceptible to easy exploitation, and owing to the unlimited market for gold, there has been no economic barrier to rapid exploitation. For this reason the trend of gold production shows ups and downs related chiefly to the advent of new discoveries and their subsequent decline, though the long-time trend of gold has been one of persistent increase. (*See Figure 2*).

The peak of gold production to date occurred in 1915 with a production of almost 23,000,000 ounces. Then followed a period of declining production which culminated in 1922 with an output of only 15,467,223 ounces. Since then production has increased slowly, the yearly average for the five years previous to 1927 having been 19,000,000 ounces.

The supply of gold has come and is coming from all the continents of the world and from nearly all countries.

The geographical distribution of production in 1927 is shown in *Figure 3*. The seven leading producing countries in 1927 were the United States (11 percent), Canada (10 percent), Russia (5 percent), Mexico (4 percent), Rhodesia (3 percent), and Australia (3 percent), the rest of the world producing only 12 percent. The trend of production in five of these countries is shown in *Figure 4*.

Almost all of the gold produced in the Union of South Africa comes from the Transvaal which, during the first quarter of the twentieth century, produced 37 percent of the world's gold output and in 1927 produced over 10,000,000 ounces, or 52 percent of the world figure. Transvaal production is still increasing, the production in 1928 having been 2 percent greater than that in 1927. The banket lodes of the Witwatersrand constitute the important source of gold in the Transvaal, only a very small part being obtained as a by-product of base-metal production.

TABLE II.—GOLD PRODUCTION OF CONTINENTS COMPARED FOR VARIOUS PERIODS (FINE OUNCES)

Period	No. of Years	World Quantity	World Pct.	North America Quantity	North America Pct.	South America Quantity	South America Pct.	Europe Quantity	Europe Pct.
1493-1600	108	22,968,491	100.00	771,618	3.36	8,204,871	35.72	4,758,310	20.72
1601-1700	100	28,848,860	100.00	1,231,373	4.27	17,811,509	61.74	3,215,074	11.14
1701-1800	100	61,205,875	100.00	3,048,398	4.98	48,965,579	80.00	3,480,118	5.69
1801-1850	50	38,035,687	100.00	8,051,910	21.17	14,570,712	38.30	6,034,454	15.87
1851-1900	50	336,230,920	100.00	121,259,441	36.06	18,788,019	5.59	17,378,541	5.17
1901-1925	25	477,526,621	100.00	137,081,784	28.71	15,381,428	3.22	8,296,072	1.74
1926-1927	2	38,746,875	100.00	9,612,115	24.81	999,982	2.58	506,282	1.31
1493-1927	435	1,003,563,329	100.00	281,056,639	28.00	124,722,100	12.43	43,668,851	4.35

Period	No. of Years	Asia Quantity	Asia Pct.	Africa Quantity	Africa Pct.	Australasia Quantity	Australasia Pct.	Various Quantity	Various Pct.
1493-1600	108	.....	.....	8,153,428	35.50	.....	.....	1,080,264	4.70
1601-1700	100	.....	.....	6,430,148	22.29	.....	.....	160,756	.56
1701-1800	100	85,399	0.14	5,465,626	8.93	.....	.....	160,755	.26
1801-1850	50	6,854,777	18.02	2,025,497	5.33	.....	.....	498,337	1.31
1851-1900	50	49,149,881	14.62	23,810,259	7.08	104,859,165	31.19	985,614	.29
1901-1925	25	51,899,805	10.87	202,209,736	42.34	62,657,796	13.12	.....	....
1926-1927	2	4,299,850	11.10	22,032,452	56.86	1,296,194	3.34	.....	....
1493-1927	435	112,289,712	11.19	270,127,146	26.92	168,813,155	16.82	2,885,726	.29

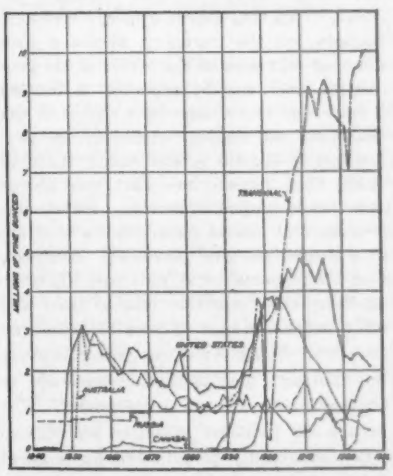


Figure 4. Production of gold in the main producing countries, 1840 to 1927

* Julihn, C. E., Summarized Data of Copper Production. Economic Paper 1, Bureau of Mines, 1928, 32 pp.
Pehrson, Elmer W., Summarized Data of Zinc Production. Economic Paper 2, Bureau of Mines, 1928, 47 pp.
Smith, Lewis A., Summarized Data of Lead Production. Economic Paper 5, Bureau of Mines. (In preparation.)

The United States at the present time ranks second in gold output, having produced 2,117,253 ounces in 1927, equivalent to nearly 11 percent of the world total. Production in this country is widely scattered, more than half of it being derived from California, South Dakota and Alaska, with Colorado, Arizona, Utah and Nevada following, in order. Placers, gold lode deposits and by-product gold from base-metal operations constitute the source of gold in the United States. In 1927, 77 percent of the gold was derived from placers and dry and siliceous ore, while 23 percent was supplied by base-metal ores, copper ores alone having supplied 17 percent. It is not to be inferred, however, that appreciable increases in gold production in the United States may be expected to result from the increase of base-metal production, as J. P. Dunlop ‡ has pointed out that the gold content of base metal ores has become so low that any considerable increase in production from this source would require tonnages of such ores far beyond present plant capacities. In 1927 the production of gold from base-metal ores was 4 percent less than in 1916; and yet, with respect to total United States output, its importance had increased from 12 to 17 percent.

Canada, now the second largest producer of gold in the British Empire, is increasing its production. The 1927 output was twice that of 1921 and three times that of 1912. Its increasing production may soon surpass that of the United States if present trends continue. The principal gold-producing provinces of Canada in 1927, in order of their importance, are Ontario, British Columbia and the Yukon; Ontario produced 88 percent of the total. While in the past much of Canada's gold has come from placers, lode deposits have been the most important sources of Canadian gold production.

Production of gold in Russia during recent years has been disturbed by political conditions in that country, but throughout the last decade there has been a persistent increase. An important part of Russian gold comes from placers. The five principal mining districts, in order of their importance for the fiscal year ended September 30, 1926, were as follows: Lena-Vitim, Aldansky, Transbaikalian, Bashkersky and Yenisei.

Since 1911 local political conditions have interfered with mining operations in Mexico, but during the last decade the production of gold, although smaller than in the first 10 years of the century, has been relatively constant. In 1927, 725,175 ounces were produced, constituting 3.74 percent of the world total, making Mexico the fifth largest producer of gold. A considerable part of Mexico's gold is a by-product from the production of other metals. The principal gold-producing states in Mexico are Mexico, where the famous El Oro district is located, Hidalgo, Michoacan and Chihuahua.

Rhodesia is the second largest producer of gold in Africa and in 1927 contributed 581,788 ounces of gold, or 3 percent of the world production for that year. Most of the gold comes from Southern Rhodesia from the Hartly, Gwelo, Bulawayo, Salisbury and Umtali districts.

Since 1903 Australian gold production has declined rapidly; in 1927 only 514,504 ounces was produced, the lowest yearly production since the discovery of gold in 1851. In spite of this being but 2.65 percent of the world total for 1927, Australia is still the seventh largest producer. The main factors responsible for the decline in gold production in Australia are (1) exhaustion of known rich deposits and (2) increased cost of stores, equipment and labor, which makes low-grade ores unprofitable. Western Australia is now the most important of Australian gold-producing states; it includes the East Coolgardie field, now producing 80 percent of the gold mined in Australia. Most of the gold from this continent has been derived from placer deposits, but at present gold lodes are the principal contributors.

It is to be expected that the Union of South Africa will continue to be the chief factor in world production for some years to come and that the proportion its production bears to that of the world as a whole is likely to increase. United States production has decreased over 56 percent since 1915, and further decrease, both in amount and percentage, is anticipated. Australia's yield of gold is now less than one-seventh of its amount a quarter of a century ago. The decline has been steady, so that material increase from this sourse appears unlikely. Canada, on the contrary, shows a pronounced increase in the trend of its production and may be expected to become a more and more important factor in the source of gold supply. Although the production of Russia is still below its 1910 peak, that nation has vast unexplored and undeveloped precious metal resources and should maintain its position as a prominent gold producer. Rhodesia and other parts of Africa are likely to continue their contributions of gold and offer much promise of possible new discoveries. South America, now relatively unimportant, may show increases due to further discovery and development. The return of political stability in Mexico will undoubtedly be followed by mineral development, which would increase the gold production of that country.

In conclusion, it should be borne in mind that the lessened gold production, now apparent, may be temporary because of the possibility of new discoveries in areas of the world that have not been intensively prospected, where other deposits comparable to those of California, Australia and the Rand may yet be revealed. Recent technological developments in prospecting, mining and metallurgy encourage such expectations.

‡ Dunlop, J. P., Gold and Silver (General Report): Mineral Resources of the United States in 1927. Part 1, Metals, Bureau of Mines, 1929.

MEASURING THE SPEED OF DYNAMITE

One of the most rapid chemical reactions known takes place when a stick of dynamite is detonated. It has been found that the detonation wave travels along a cartridge of dynamite at speeds as high as 4 miles a second. These speeds are measured at the Explosives Experiment Station of the United States Bureau of Mines, at Bruceton, Pa., in connection with research and testing of mining explosives.

In one type of apparatus, known as the Mettegang recorder, the time elapsing between the breaking of two wires threaded through the explosive is recorded on a rapidly revolving smoked drum. In a method recently developed, the explosive is placed behind a narrow slot cut in a sheet of armor plate and the detonation process is photographed by its own light on a rapidly moving film.

The suitability of an explosive for a given blasting operation depends to some extent on its rate of detonation, hence, a study is being made by the Bureau of Mines of the speed of dynamites when detonated under confinement closely approximating that obtained in actual blasting.

COMPILATION OF INFORMATION ON NON-METALLIC MINERALS

The building up of a file of technical information on non-metallic minerals has been an important activity of the Building Materials Section of the Bureau of Mines, since the organization of that section in May, 1928. The files cover about 40 minerals, the more important of which are: stone in all its branches, sand and gravel, cement, lime, slate, clay, asbestos, feldspar, fluorspar, talc and soapstone, abrasives, and silica. Under each commodity there are subclassifications such as analyses, costs, lists of producers, milling, mining, occurrence, preparation, prices, production, specifications, substitutes, tariffs, transportation, uses, and many others. Thereafter a series of geographical folders are alphabetically arranged covering each state or country on which information concerning this particular commodity is available.

METALS

GUY N. BJORGE
Editor

Practical Operating Problems of the Metal Mining Industry

By W. E. HALES *

The Tybo plant of the Treadwell Yukon Company, showing Hales shaft, crushing plant, flotation plant, concentrate bins, change rooms, machine shop, assay office, carpenter shop, office and, on the right, dormitory boarding house

The TYBO MILL

Highly complex ores and their treatment described—Flow sheet and equipment detailed—Requirements and application of reagents given, with smelter returns on concentrates

THE Tybo mines of the Treadwell Yukon Company, Ltd., are located at Tybo,† Nye County, Nev. The nearest railroad station is at Tonopah, Nev., 70 miles west of the camp, where the company maintains a rail siding, warehouse, and loading bunkers for concentrate. All hauling is done by trucks, which make a round trip from Tonopah to the mines in 12 to 14 hours.

Ore was first discovered in Tybo in 1866, and the district was organized in 1876. In 1876 the town boasted of a population of over 1,000 inhabitants, a newspaper, five stores, two blacksmith shops, livery stable, school, jail, and numerous saloons.

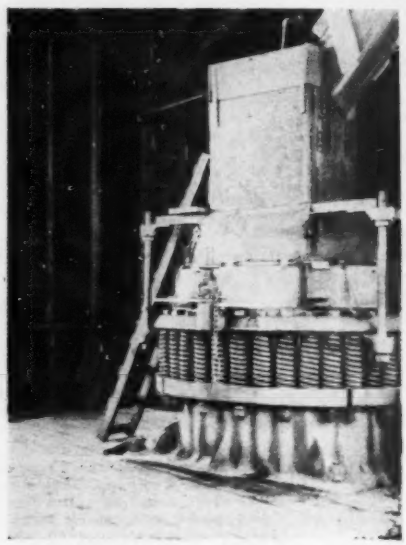
The following geological data is taken from a report on the district issued at that time: "The formation of the district is limestone and porphyry, running east and west, the veins running with the formation, and dipping nearly perpendicularly. The ores are base containing lead, iron, and zinc, with values of seven-eighths silver to one-eighth gold. The principal mines are the Lafayette, Casket, and 2 G. The latter is the most thoroughly developed, having a shaft 400 ft. in depth. The ore is principally gray and yellow carbonates and argentiferous galena."

W. B. Hales, superintendent and W. H. Blackburn, manager

* Superintendent, Treadwell Yukon Company, Limited, Tybo, Nev.
† The Pau-Ute Indian name for white man.

In 1872 the Tybo Consolidated Mines erected a lead smelter, operating two furnaces with a capacity of 80 tons per day, using locally burned charcoal as fuel. The smelter operated until 1879, when it was closed down, throwing 400 men out of employment. Soon afterward a 20-stamp mill was erected, and the ores were treated by the Reece River process; i. e., pan amalgamation, preceded by a chloridizing roast. The records indicate a recovery of 78 to 81 percent of the silver by this process on ores which averaged from 25 to 30 oz. of silver to the ton. This plant operated until 1888, when it was abandoned, due to the exhaustion of the oxidized surface ores which were amenable to the process.

In 1917 the Louisiana Consolidated Mining Company acquired the properties and erected a concentrator and lead smelter. This venture was unsuccessful, due to the high iron and zinc content of the ore, no method at that time being available for the separation of these minerals.



Four-ft. Symons cone crusher

The properties were brought to the attention of Mr. F. W. Bradley, president of the Treadwell Yukon Company, in 1925, and were examined by Mr. W. H. Blackburn, upon whose recommendation an option was taken. Intensive exploration work was started under Mr. Blackburn's management, with Mr. W. E. Hales as resident superintendent.

A power line was first brought from Manhattan, Nev., a distance of 40 miles, at a cost of about $40,000. The original 2 G shaft was unwatered and repaired and a 4-stage Krogh centrifugal pump installed on the 400-ft. level. Sinking was continued to the 710-ft. level, where a station was cut and two 4-stage Krogh centrifugal pumps installed. These pumps handled 1,100 g. p. m. A station was also cut on the 560 level and crosscuts driven to the vein. On the 560-ft. level a drift was extended 500 ft. east, and on the 710-ft. level drifts were extended on the vein 1,200 ft. east and 1,400 ft. west.

At that time sufficient tonnage was developed to warrant the erection of a modern selective flotation concentrator. It was decided that a new shaft was necessary for economical mining, and a site was selected just above the projected mill site, a distance of 700 ft. easterly from the 2 G shaft and in the hanging wall of the vein. From the vein crosscuts were driven from the 300, 400, 560, and 710-ft. levels, and an adit was driven 180 ft. below the collar. Raises were run simultaneously from these levels and after "holing through" timbering was started from the surface and completed to the 710-ft. level. A station is now being cut at the 860-ft. level, and when completed the new shaft will be sunk to 1,100 ft. and the vein explored from both points.

Construction on the concentrator was started in November, 1928, and the plant which was designed and constructed by Lloyd C. White, of Hershey and White, mining and metallurgal engineers, of San Francisco, went into production May 13, 1929.

Accessory buildings and equipment were erected, including a main office and engineering building, machine, blacksmith, carpenter, and electrical shops, assay office, change rooms, two dormitories to accommodate 150 employes, boarding house, storehouse and warehouses, all heated from a central heating plant. A fire and water system, and a sewer system connected to a modern septic tank, were installed, and seven modern dwellings were built for the staff.

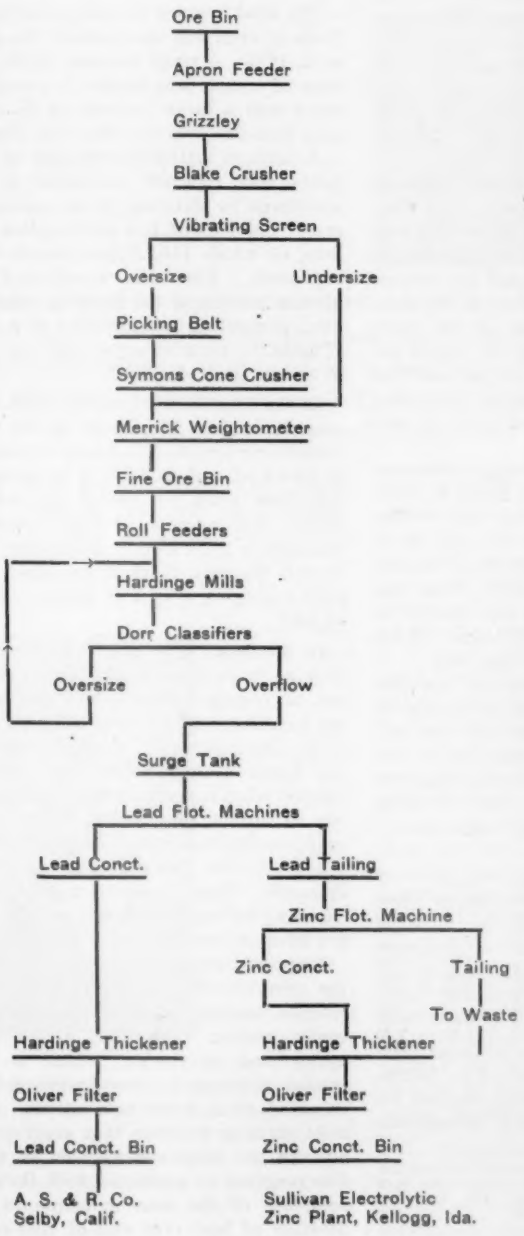
Fleet of Fageol trucks with trailers hauling concentrates to Tonopah

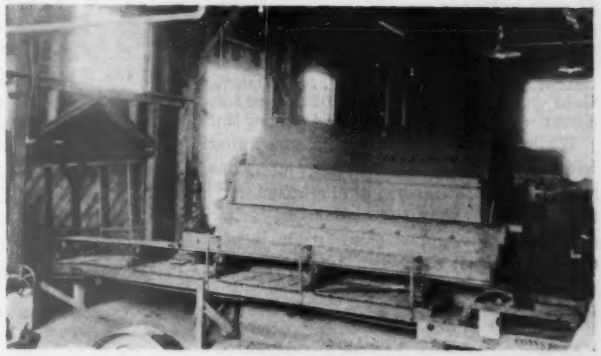
An analysis of a composite sample of the ores developed by the Treadwell Yukon Company between the 400 and 710-ft. levels is given below:

Silica	32.05%
Iron	15.08%
Alumina	11.48%
Calcium oxide	7.73%
Magnesium oxide	1.62%
Phosphorus	0.24%
Sulphur	16.56%
Lead	7.38%
Zinc	5.56%
Copper	0.02%
Nickel	Trace
Cobalt	None
Vanadium	None

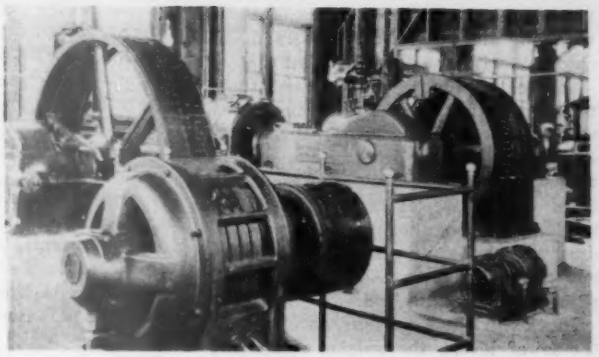
Old photograph showing the smelter at Tybo in 1874

FLOW SHEET OF CONCENTRATOR, TREADWELL YUKON COMPANY, LIMITED

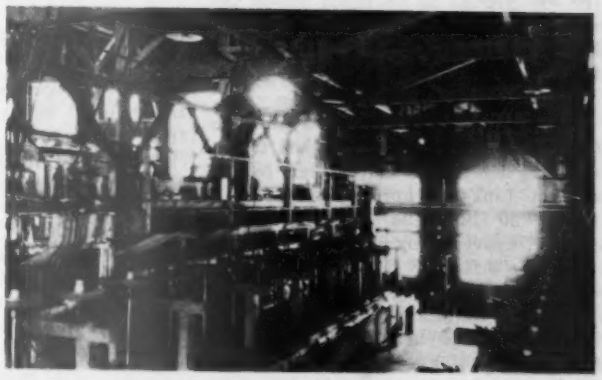




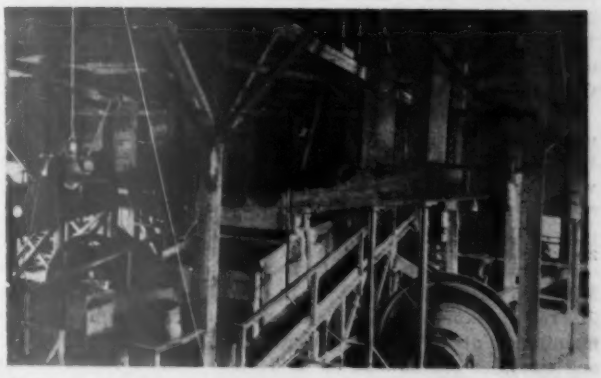
Oliver filter



Compressor room



Flotation cells



Dorr classifier and Hardinge ball mills

Barium sulphate	None
Manganese	0.26%
Arsenic	0.59%
Antimony	0.13%
Cadmium	0.06%
Gold	0.02 oz. per ton
Silver	10.81 oz. per ton

While most of the silver is associated with the galena, the sphalerite and pyrite are both argentiferous, the relative content in the last two minerals being greater in the upper than in the lower levels. Typical assays of pure minerals give the following results:

Galena .. 110.0 to 130 oz. silver per ton
Sphalerite. 7.0 to 20.0 oz. silver per ton
Pyrite .... 8.0 to 11.0 oz. silver per ton

The sphalerite so far treated is high in chemically combined iron, pure specimens containing from 50 to 55 percent zinc and 10 to 15 percent iron, the iron replacing the zinc isomorphously in accordance with the formula (ZnFe)S.

Above the 400-ft. level the ores have undergone considerable oxidation, with many evidences of secondary enrichment and mineralization. In earlier operations while practically all the completely oxidized ores were extracted above this level, large bodies of partially oxidized ores were left untouched. At the present time these ores comprise about 50 percent of the mill feed.

In the primary ores as developed in the lower levels, the galena, sphalerite, and pyrite crystals are easily discernable to the eye, and under the microscope the ore ground to 65 mesh, shows the minerals to be almost completely unlocked or separated from the gangue and from each other.

Concentrator Operations

Crushing.—Ore is delivered through the new three-compartment shaft to the receiving bin at the shaft collar, fed by a 36-in. Link-Belt apron conveyor to a 10 by 30 in. Allis Chalmers Blake crusher, conveyed by a 24-in. belt conveyor to a 3 ft. by 8 ft. Link-Belt vibrating screen, screening to ⅝ in. Oversize to a 30-in. picking belt, where wood, iron, and waste are picked from the feed, then to a 4-ft. Symons Cone crusher, crushing to ⅝ in. Undersize to a 20-in. belt conveyor, which joins the product from the Symons crusher on a 20-in. conveyor, passing over a Merrick Weightometer to a 20-in. distributing conveyor to the 1,400-ton fine-ore bins. Crushing rate, 65 tons per hour.

Fine Grinding.—The fine grinding equipment consists of two 8 ft. by 48 in. Hardinge mills, each in closed circuit with a Dorr "D" classifier, 6 ft. by 25 ft. Mills are fed by Link-Belt 18 in. by 12 in. roll feeders. Ball-mill density is maintained at 75 to 78 percent solids, and classifier overflow at 30 to 34 percent solids. This product averages 68 to 72 percent minus 200 mesh.

Lead Flotation.—A 16-cell 18 in. by 31¼ in. Minerals Separation machine is used for the flotation of lead. Spindles are driven in pairs by eight G. E. 7½-hp. vertical motors, using tex-rope drive. Overflow from classifiers gravitates to a surge tank, thence to cell No. 4 of the flotation machine. A finished concentrate is taken from cells Nos. 4 and 5, the rougher concentrate from cells No. 6 to No. 10 is circulated back to the head of the machine, cells Nos. 1, 2, and 3 being used as cleaners, making a finished concentrate. Rougher concentrates from cells Nos. 11, 12, and 13 is returned to cell No. 8, and rougher concentrate from cells Nos. 14 and 15 is returned to cell No. 11, cell No. 16 being used as a conditioner, for the zinc circuit. Density of pulp, 27 to 30 percent solids.

Zinc Flotation.—A duplicate Minerals Separation machine is used for the flotation of zinc. Tailings from the lead flotation flow by gravity to the head of the zinc machine. A finished concentrate is taken from the first four to six cells, depending on the grade of the feed, rougher concentrate up to the eighth cell is returned to the head of the machine, and from cells Nos. 9 to 16 is returned to cell No. 4. Density of pulp, 25 percent solids.

Thickening and Filtering.—Finished concentrates are pumped to 24 ft. by 8 ft. Hardinge thickeners, by 2-in. Wilfley pumps, filtered on 5 ft. 4 in. by 10 ft. Oliver filters, and conveyed by 18-in. belt conveyors to their respective bins, and hauled by Fageol trucks and trailers to the railroad siding at Tonopah. Each truck averages 20 tons to the load.

Reagents.—The amount and combination of the reagents employed depend on the grade and character of the ore, larger quantities being required in the treatment of partially oxidized than the straight sulphide ores. The following table indicates the average requirements and application:

	Ball Mills	Lead Section	Zinc Section	Total
Soda Ash	1.80	0.60	....	2.40
Sodium Cyanide	0.30	0.20	....	0.50
Zinc Sulphate	0.50	0.30	....	0.80
Copper Sulphate	....	....	1.50	1.50
Ethyl Xanthate	....	0.08	0.08	0.16
Amyl Xanthate	....	0.03	0.02	0.05
Cresylic Acid	....	0.80	....	0.80
Barrett 634	....	....	0.06	0.06
Lime (hydrated)	....	....	2.20	2.20

Concentrate Production.—The following table gives the average smelter returns on lead and zinc concentrate shipped to date:

	Au	Ag	Pb	Zn	Fe	Ins.	S	As	Sb	H_2O
Lead Conct.	0.20	93.4	64.39	2.70	6.8	3.6	15.3	1.4	1.0	8.0
Zinc Conct.	0.03	12.10	2.27	48.30	11.5	2.9	28.0	...	...	8.5

The metallurgical results have in general been consistently better than the laboratory results, upon which the plant was predicated, and have fulfilled the expectations of the management.

GREAT VARIETY OF REAGENTS USED IN TREATING LARGE TONNAGES OF ORES IN 1928

A total of 50,073,450 tons of ore was treated in this country by the flotation process in 1927, according to figures collected by the United States Bureau of Mines, in cooperation with the University of Utah. By far the greater portion, 40,881,768 tons, consisted of copper ores. The remainder was made up of complex lead-zinc, lead, zinc, copper-iron and miscellaneous ores.

The total tonnage treated, including all kinds of ores, was substantially the same as in 1926. A small decrease in the tonnage of copper ores treated is noted, but there was a large increase in the complex lead-zinc ores and zinc ores treated.

A total of 220,514,373 pounds of reagents was reported consumed in the treatment by flotation of all classes of ores. The bulk of this consumption was lime, of which 169,926,145 pounds were consumed. Pine oils constituted the greater portion of the frothing reagents used, accounting for 5,064,320 of a total of 6,583,151 pounds; appreciable amounts of cresols were also used.

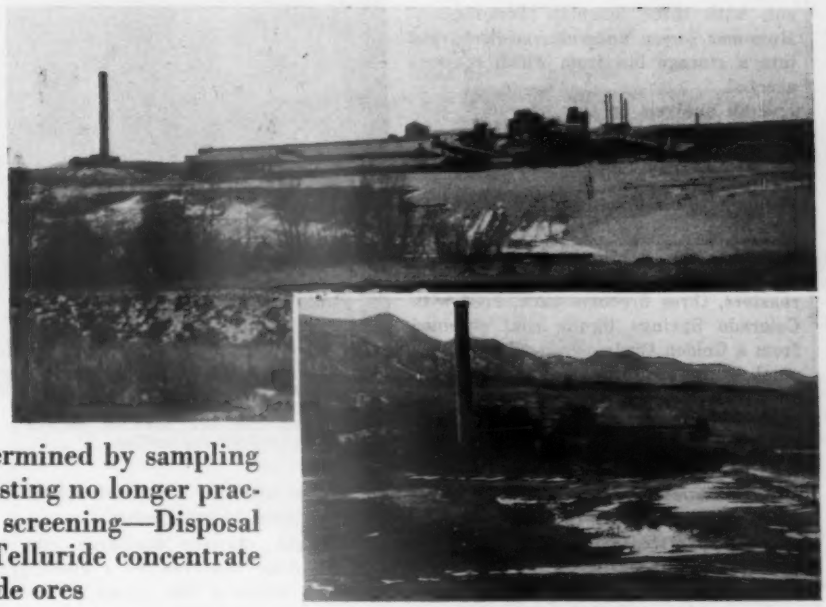
In the treatment of copper ores, lime constitutes over 90 percent of the total reagent consumption in terms of weight; in terms of cost as well, it is apparent that lime must be one of the largest items. The amount of lime consumed averages a little over 4 pounds per ton of ore, whereas there is no other reagent averaging over 1/10 pound per ton of ore.

In the flotation of zinc ores, the most striking feature is the large and general use of copper sulphate, and the large but localized use of sodium silicate. The large consumption of copper sulphate in the flotation of straight zinc ores is natural when it is considered that sphalerite is almost universally floated as a copper-sulphide-surfaced mineral. When compared with straight lead ores, it is apparent that proportionally more chemical collectors and less of the oils are used in the flotation of zinc ores.

The most interesting, perhaps, of all the ores included in this study are the complex lead-zinc ores. These ores generally contain substantial amounts of pyrite and pyrrhotite, which is discarded, although in some instances it is collected as a third concentrate. The most striking features that are brought out are the large consumption of alkaline reagents as compared with the consumption of the same reagents in the flotation of lead ores and of zinc ores; the large consumption of cyanides, zinc sulphate, sodium sulphite, and the comparatively large amount of collectors, both oils and chemicals, that apparently are needed.

ORE TREATMENT Methods and Practice in the Golden Cycle Plant

By M. F. DYCUS *



Treatment of complex ores determined by sampling of each shipment—Separate roasting no longer practiced—Roasting controlled by screening—Disposal of tailings a special problem—Telluride concentrate made for low-grade ores

Above—Golden's Cycle Mill
Below—Golden Cycle Mill. Pike's Peak in background

THE Golden Cycle Corporation operates its mill at Colorado Springs, primarily, on straight sulpho-telluride gold ores from the Cripple Creek district. The original and major portion of the plant consists of a roasting combination slime and leaching cyanide plant with a capacity of from 900 to 1,000 tons daily. Very little silver and practically no lead, zinc, or copper are contained in this ore.

M. F. Dycus

Until two years ago no attempt was made to handle business outside of this district; however, at that time a small amount of silver and also some high-grade free gold ore became available. It was decided to install a 40-ton nonroasting all-sliming cyanide unit, which has been operating since.

More recently a 200-ton flotation unit has been added to handle still other classes of ore. There are, within the state, numerous small properties with ores carrying gold and silver values but with enough copper content to bar their shipment to a strictly cyanide plant. There are also those with gold or silver values with enough lead or zinc content to demand payment, which is impossible in a plant with exclusive cyanide treatment. Still again, there is a great tonnage of very low-grade telluride gold ore in the Cripple Creek district that it is not necessary to bulk roast. The flotation plant is designed with enough elasticity to handle any of these.

Each shipment of ore, when received, is passed through the sampler and then classified and bedded in a storage bin according to the method of treatment to follow. General run of ore through sampler is crushed in Blake crushers and 42 by 14 in. rolls to 3½ to 4 in. product before passing to storage bins. Preliminary and secondary crushing equipment is sufficiently large to handle the tonnage for all types of ore during the 24-hour period. This is followed by individual storage bins for each.

General or Major Plant

At one time Cripple Creek ores were separated into two classes and kept separate in storage bins according to the lime content of each. The so-called siliceous or low-lime ore was then roasted separately and in a somewhat different manner than the high-lime ore. The siliceous ore, for example, was passed through at a greater speed and with heat adjusted to a lower temperature. Beds of each were made as large as possible, but even so it was a constant source of annoyance and trouble when changing from one to another. It requires from five to six hours for the ore to pass through the roasters, and with individual bins feeding each it was impossible to prevent at least a certain amount of mixing at each change. This system has all been discarded. Cripple Creek ores, of sufficient value to allow roasting at all, are bedded together and the best possible roast given on the mixture. Immediately preceding roast, however, the coarser ore is screened out and roasted separately but united with fines again immediately following.

An approximate analysis on head ore from the Cripple Creek district is as follows:

Au.	0.46 oz.
Ag.	0.14 oz.
Insol	82.54 %
Al_2O_3	2.86 %
Fe	3.54 %
CaO	3.22 %
S	1.93 %
MgO	0.87 %
Ign. Loss	4.62 %
	99.58 %

Storage bins discharge onto conveyor belt with Dings magnetic pulley terminal

* Golden Cycle Corporation, Colorado Springs, Colo.

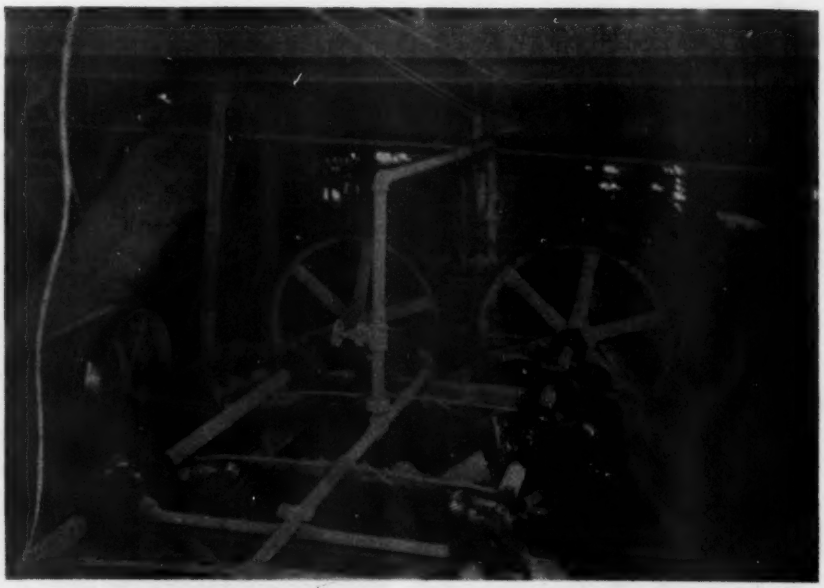
for the removal of tramp iron. The flow then passes over a ⅝ in., square mesh, screen; oversize feeding a 5½-ft. Symons cone crusher. Undersize is united with cone-crusher discharge and passed over four Hum-mer screens, fitted with Ludlow Saylor Rek-Tang screens No. 817 (approximately 4½ mesh) in closed circuit with three Schmidt "kominuters." Hum-mer screen undersize is discharged into a storage bin from which roasters are fed.

Mesh analysis on this product:

On 5/32-in. screen	2%
On ¼-in. screen	9%
On 10-mesh screen	38%
Through 10-mesh screen	51%
	100%

There are eight Edwards Duplex roasters, three fireboxes each, fired with Colorado Springs lignite coal obtained from a Golden Cycle owned mine 6 miles north of town.

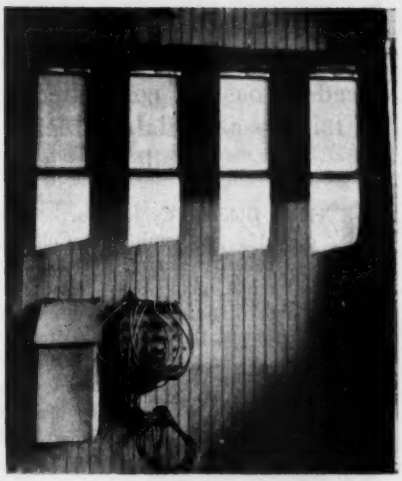
In order to get the best possible control in the roasters it has proven of great value to screen the ore immediately ahead. This is accomplished with three Hum-mer screens fitted with No. 268 Rek-Tang screens (approximately 6-mesh). Oversize is then fed to two roasters and undersize to the other six. Heat on the coarse roasters is maintained at from 800 to 850 degrees C., while on the fine roasters it is somewhat lower, 750 to 780 degrees C. All fireboxes are fitted with Brown electric pyrometers, enabling firemen to keep a definite, constant temperature, with very few variations, either high or low. Recording pyrometers are installed in superintendent's office, also, for a check on operation for the entire 24-hour period.



Edwards Roasters, showing method of driving rabbles

All eight roasters discharge into a common drag conveyor in a dust-tight chamber, where a thin spray of water is played on the still warm ore, which tends to cool it somewhat. The amount added is very limited, however, as each ton added cuts the ultimate water wash on final tailings exactly that amount.

The drag conveyor discharges onto a specially prepared rubber hot ore belt conveyor which delivers the ore to



Brown electrical pyrometer recorder to control roaster temperatures

Dorr bowl classifier

Chilean mills grinding in 1.6 lb. NaCN solution. These mills are fitted with No. 116 Ludlow Saylor Rek-Tang screens (0.0496 in. openings). The product is equivalent to about 18-mesh. Each Chilean mill is followed by a corduroy blanket table 16 by 12 ft. in four sections with 3-in. drop between.

No attempt is made at close concentration, the only requirement being that no particle of coarse gold escapes which will lack sufficient time for dissolution in the process to follow. At that, the blankets recover from 32 to 34 percent of the total gold content. These concentrates, after amalgamation in small grinding pans, are passed over another blanket and returned to regular plant circuit.

Following blankets, product is pumped into an 8-ft. Dorr classifier with 12-ft. bowl, carrying a heavy backwash. Practically all colloids are washed from

sands, producing an ideal leaching product. The sand, about 75 percent of the total tonnage, is fed in a semidry condition into 1 of 11 50 by 7 ft. steel leaching tanks with a capacity of 600 tons of dry sand. With a total of 11 leaching tanks it is ordinarily possible for sand to remain in tanks and under treatment for a total of seven or eight days with, at least, five drainage periods of eight hours each, for aeriation.

The first solution coming from freshly filled sand tank is taken, direct, to gold storage tanks for immediate precipitation, but after 48 hours it is diverted, used as a wash on other tanks, and built up in value before precipitation.

When leaching process is complete, valves discharging at the bottom of tank into wooden launders are opened. These launders are directed into a sump from which a 6-in. centrifugal pump throws sand to the tailing pile. A Wilfley booster pump, and in some cases two, are necessary to distribute sand to extreme points. Two experienced men, each handling a 2½-in. fire hose carrying 100 lbs. pressure, can move sand to discharge valves, cleaning the 600-ton tank in slightly more than three hours.

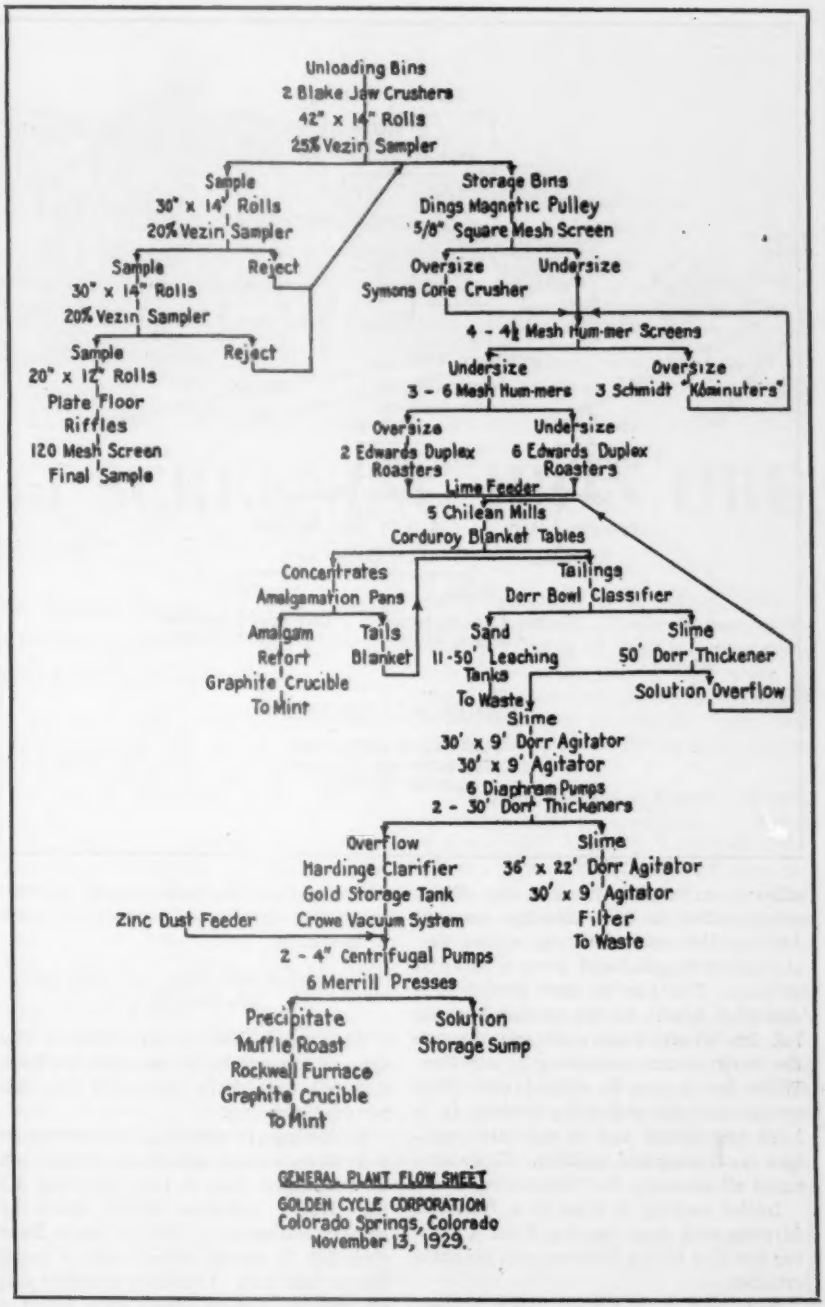
Typical final sand tailing analysis:

	Pct.	Oz. Au
On 20-mesh screen.....	16	0.01
On 30-mesh screen.....	25	0.01
On 40-mesh screen.....	20	0.01
On 60-mesh screen.....	21	0.01
On 100-mesh screen.....	7	0.02
On 150-mesh screen.....	6	0.02
On 200-mesh screen.....	3	0.02
Through 200-mesh screen...	2	0.03
Average	100	0.012

The slime overflow from Dorr bowl classifier carries about nine parts of solution to one of solids. Nearly all of the solids will pass a 100-mesh screen with 92 to 94 percent through a 200-mesh screen. This product is fed to a 50-ft. Dorr tray thickener, where it is thickened to approximately 40 percent solids, overflow solution returning to Chilean mills. Positive slime discharge control is obtained by means of four Dorr diaphram pumps discharging into two 30-ft. agitators, in series, for agitation, aeriation, and redilution. Secondary thickening and further agitation is carried out by means of two 30-ft. thickeners, in parallel, and one 37 by 23 ft. agitator and one 30 by 9 ft. agitator, in series. The total time of slime agitation is from 60 to 72 hours.

Filtering plant consists of two Moore improved vacuum filters (Butters type) with 87 canvas leaves in each.

As the Dorr classifier sand discharge has a lower gold content than the slime overflow, so is the sand final tailing lower in value than the slime tailing. The final slime tailing carries 0.028 oz. gold per ton, as against 0.012 oz. in the sand.



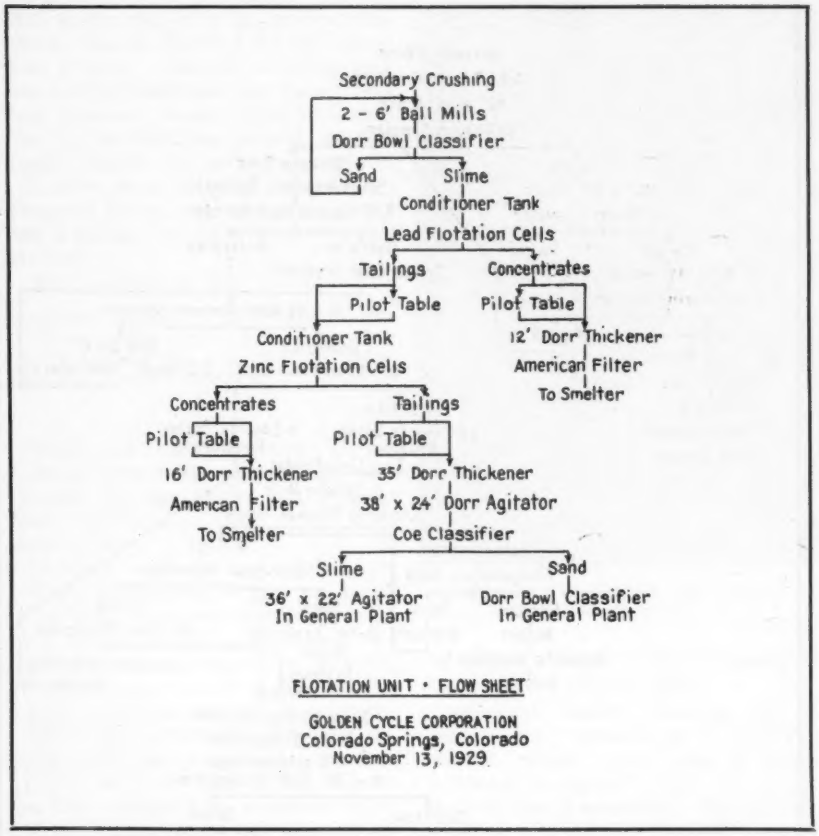
GENERAL PLANT FLOW SHEET
GOLDEN CYCLE CORPORATION
Colorado Springs, Colorado
November 13, 1929.

Secondary thickener solution overflow is clarified in a Hardinge sand clarifier and united with initial washes from both the leaching and filter plants to form the head solution for the Merrill zinc dust precipitation presses. Before passing to presses, solution is deaerated in a Crowe vacuum system. Centrifugal pumps are used to feed presses, high-pressure stuffing box solution being the only necessary precaution against air contamination.

While it is desirable to precipitate the solution highest in value, there is one great objection to the practice here. The warm ore, direct from the roasters, tends to warm the solution. This becomes saturated with calcium sulphate which precipitates as it cools, filling pipes, launders, tanks, classifiers, etc., with its crystals. For this reason it is impractical to go direct to Merrill presses, while solution is still warm, but first cooled by circulation throughout the plant. This is better practice, even at the added expense of precipitating more solution and of a lower grade.

At some points in the plant solutions assay as high as $6 to $7, but it is seldom that zinc press heads will assay over $3.50. Press tails average $0.02 per ton.

Precipitates are cleaned from presses



FLOTATION UNIT • FLOW SHEET

GOLDEN CYCLE CORPORATION
Colorado Springs, Colorado
November 13, 1929

after a run of about three weeks. These are handled in the following manner: Into an iron pan a definite of the precipitate is weighed and given a cover of nitrate. The pan is then placed in a coal-fired drier. As the product becomes hot the nitrate runs over and through the entire mass, cementing it together. While hot it can be stirred with little or no dusting, and after cooling it is hard and brittle and in splendid condition for fluxing and melting. This eliminates all necessity for briquetting.

Initial melting is done in a Rockwell furnace with final barring from a Denver fire clay tilting furnace with graphite crucible.

Our method of tailing disposal is to pump sand along the edge of the tailing area through a 6-in. pipe with perforations on under side. This distributes the sand over a distance of several hundred feet in the form of a dam and serves as a retaining wall for the slime tailings pumped within the enclosure. If handled properly, sand can be made to stand at a very steep or very flat angle according to requirements. Overflow spillways are supplied for the removal of clear water as slime settles. At this time tailing pile amounts to seven or eight million tons and tailings disposal becomes more of a problem yearly. It is not altogether a question of space, although this is a consideration, but the elevation to which tailings must be lifted is making the power consumption quite a factor.

Silver Ore and Gold Ore Requiring No Roasting

At present there is very little of this type of ore available; however, we have a small unit, built especially for this purpose, running.

Following dry grinding to 2 percent on a 5/32-in. screen, ore from storage bin is discharged into a pipe carrying 1.5 lbs. NaCN solution which flows by gravity a distance of 260 ft. into a Dorr classifier in closed circuit with a small Marcy ball mill. Classifier overflow will all pass a 60-mesh screen with about 8 percent on 100-mesh. This product is pumped into a Dorr 30-ft. thickener, clear solution overflowing immediately into gold storage tanks in general plant ready for precipitation. Thickened slime discharges into a 30 by 9 ft. agitator where enough NaCN is added to bring strength up to 3.5 lbs. per ton. Up to this time the NaCN content has been under 1.5 lbs. per ton, which is close to the maximum strength elsewhere in the plant. As silver ores and even gold ores in this portion of the plant must necessarily carry more metal per ton than those from the Cripple Creek district, the make-up cyanide solution is fed direct to this agitator. This agitator, in turn, discharges into a Coe classifier, overflowing into general plant agitator immediately following primary thickener. In this manner all ores in this portion of plant receive somewhat longer treatment than those in the general plant. Coe classifier sand discharges into Dorr bowl classifier in general plant.

Lead, Zinc, and Copper Ores, With or Withour Gold or Silver

The most recent addition to the plant, and one which even yet has operated hardly long enough for comment, is the flotation plant and auxiliary equipment. It has been built as flexible as possible in order that the many different types of ore may be handled individually, taking any of several variations of treatment, with both concentrates and tailings, following flotation.

Ore from the storage bins is ground in two Colorado Iron Works ball mills in closed circuit with Dorr bowl classifier overflowing approximately a 100-mesh product. This flows by gravity, a distance of 350 ft. in an open launder, to flotation conditioner tank.

One 10-cell Denver Equipment Company Fahrenwald flotation machine for lead concentration is followed by another conditioner and Fahrenwald machine of 12 cells for zinc concentration.

The concentrates from each are pumped into separate thickeners for dewatering. A five-compartment American filter serves to prepare both the lead and zinc concentrates from thickeners for shipment. The thickeners and filter are so situated that final lead and zinc concentrates can be loaded, direct from filter, to railroad cars for their respective smelters.

If flotation tailings carry gold or silver values they are subjected to cyanide agitation and treatment, otherwise they are rejected immediately following flotation machine. If for treatment, they are first thickened in a 35-ft. Dorr thickener and passed on into a Dorr agitator where NaCN is added to the extent of about 1.0 lb. per ton of solution. This agitator discharges into Coe classifier and given the usual slime agitation treatment in the general mill circuit.

Low Grade Cripple Creek Ores

Ores from the Cripple Creek district, lacking sufficient values to justify bulk roasting, are handled in exactly the same manner as other ores in the flotation plant excepting that instead of making a lead or zinc concentrate, a telluride concentrate is made. Also the concentrates, in this case, from the American filter, are loaded into a railroad car and dumped back into the general unloading bin to be mixed with the regular run of Cripple Creek ore for roasting.

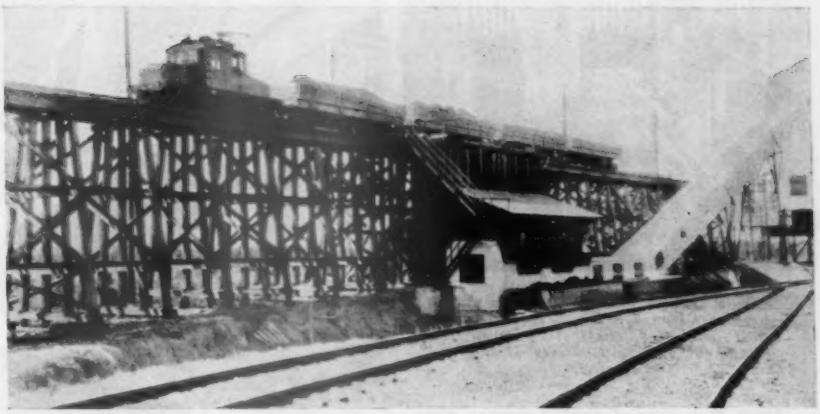


Figure 1—Ore dumping trestle, screening plant and inclined belt conveyor to washery building. Hanna Ore Mining Company, Mesabi Chief Mine, Kewatin, Minn.

New Methods in SCREENING IRON ORE

By R. S. WALKER *

New plant at Mesabi Chief Mine on Mesabi Range proves highly satisfactory—First iron ore screening plant of its type—Description of plant and results obtained

A NEW method of screening iron ore was the result of an investigation made by the Hanna Ore Mining Company, a subsidiary of the M. A. Hanna Company, of Cleveland, Ohio, when laying out the plant for their Mesabi Chief mine on the Mesabi Range, at Keewatin, Minn.

They investigated thoroughly the methods of iron-ore screening, as it was their intention to build a new screening and ore-washing plant that would give them less trouble and maintenance expense, and require less man power than before.

Through collaboration of their skilled field operating men on the iron range, Link-Belt engineers, and the author, a very novel screening plant was developed.

The Hanna Ore Mining Company have completely electrified the entire operation of this iron-ore pit, installing four 60-ton General Electric swivel truck type electric locomotives operating on 600 volts direct current; one of which is shown in *Figure 1* with four dump cars on the trestle.

In the pit they installed a Bucyrus 225B electric shovel with an 8-yd. dipper and two 120B electric shovels with 4-yd. dippers. These shovels are equipped with d.c. motors operated from motor generator sets having Ward-Leonard control. Power is brought to them by means of flexible cables from pole lines in the pit, at 2,200 volts, 3-phase, 60 cycles, which has been stepped down from the Minnesota Power and Light Company's incoming high-tension line at 20,200 volts.

The screening system determined upon is illustrated in *Figures 2 and 3*. It was designed and built by Link-Belt Company. It is a combination of fixed inclined grizzly bars forming a receiving hopper, with two pairs of shaker screens, which serve as the bottom of this screening hopper and finish the screening.

The iron ore, loaded at the pit, about a mile and a quarter away, is brought up the trestle, and these 30-yd. air-operated side dump cars, made by the Differential Steel Car Company, dump, from the top of the trestle, their entire contents sidewise into the hopper.

*Consulting Engineer, the M. A. Hanna Company, Cleveland, Ohio.
Prepared in collaboration with J. W. Wilson, Link-Belt Company.

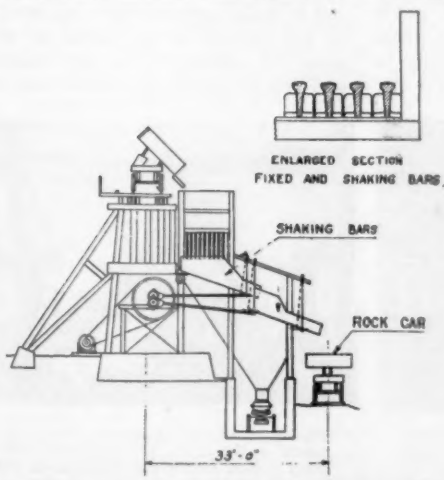


Figure 2—End elevation of dump hopper and screening plant installed May, 1929.

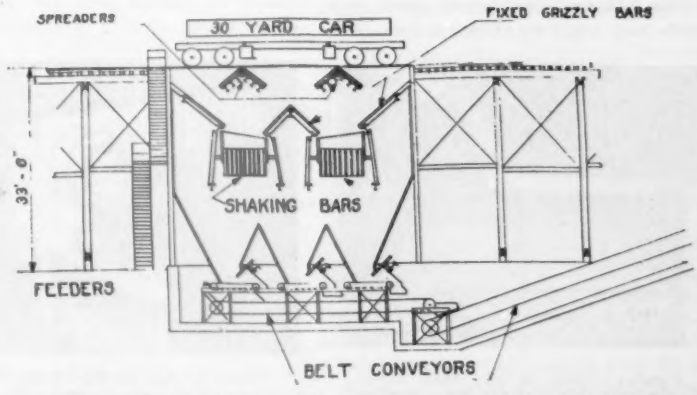


Figure 3—Diagramatic view of iron ore screening plant showing cascading arrangement in stationary screening, dump bin and shakers fitted with screen bars forming bottom of bin. Capacity about four 30-yd. cars in 5 minutes. Capacity of each of 3 feeders 140 T. P. H.

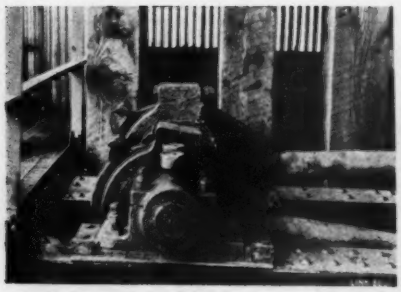


Figure 5—End view of eccentric shaft with cast iron ball faced eccentric and split babbitted cast steel eccentric straps for driving two sets of shaker screens.

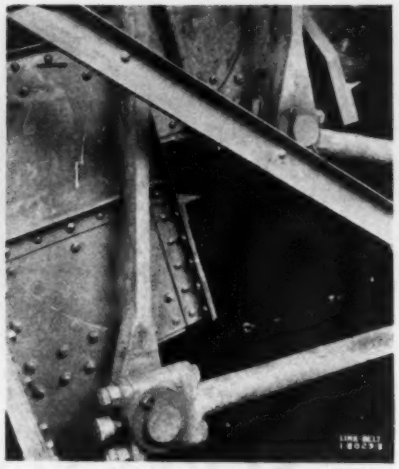


Figure 4—Upper and lower shaker screen crosshead shafts and lower hanger connection for ore shaker screens.

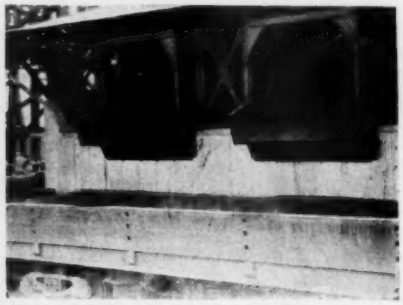


Figure 6—Partial end view of iron ore screening plant showing two sets of 7-ft. wide hanger type shaker screens with manganese screen bars.

Over each pair of shaker screens, near the top of the hopper, a solid deflector is built, so that the dumped material from the car spills over stationary manganese steel screen bars, and about 60 percent of the screening is done by these bars, which are spaced 4½ in. apart. The balance of the screening is done by the shaker screens, which also act as conveyors for carrying the oversize rock and discharging it into the rock car, as shown in *Figure 2*.

The manganese screen bars, both in the fixed hopper section and in the shaker screens, are similar in cross section, being specially designed for this kind of service. They are so made that they are set in place, without being bolted down, and space themselves. They have proven to be practically self-cleaning.

The shaker screens are of the hanger type, except that the upper end of each upper shaker screen is supported on rollers.

The drive for the shaker screens uses a 50-hp. motor connected by a belt to a 96-in. x 18-in. crown face flywheel pulley mounted on a 4 15/16-in. eccentric shaft. The eccentrics are so mounted as to give opposite balanced motions in the upper and lower screens of each pair of screens, and prevent rocking action in the structure.

The hangers are forged from solid billets and are 2 in. thick by 4 in. wide, with the lower ends formed as is shown in *Figure 4*, which also shows the crosshead ends of the connecting rods running to the same 4 15/16-in. eccentric shaft. The upper screen has an inside assembly, and the lower screen has an outside assembly, to avoid interference.

An end view of the 4 15/16-in. eccentric shaft is shown in *Figure 5*. This shaft is made in two pieces connected together with a flanged coupling, so both shaker screens are driven off this same shaft with a single motor.

The shaker screens are 7 ft. 6 in. wide, run at a speed of 85 strokes per minute, and are set on a 19-degree pitch. The manganese steel screen bars in both the upper and lower shakers are spaced 4½ in. apart. *Figure 6* is an end view of the two sets of shaker screens, showing the arrangement of screen bars, and the drop between the upper and lower screens—purposely made so that any large flat or slabby pieces that would have a quantity of loose ore on them would be turned over and bumped, to clean it off, making it possible for the lower screen to drop this ore through to the bin below.

As noted in *Figures 2* and *3*, underneath the shaker screens is the screenings bin, with capacity of about 200 tons, below which are three cast-steel heavy-duty flat-top apron feeders, 30 in. wide, 6 in. pitch, having the carrying side supported on 8-in. diameter rollers, as shown in *Figure 7*.

A worm-gear-operated slide gate for the front of the hopper feed is provided to regulate the quantity fed to the washing plant.

Each of these apron feeders is driven with a 5-hp. motor through a triple reduction Link-Belt herringbone speed reducer (Sykes tooth form), the final reduction being through an encased Link-Belt RC-177 finished steel roller chain drive to the head shaft of the feeder. This driving unit is shown in *Figure 8*.

Underneath the feeders is a 30-in. wide Link-Belt antifriction type collecting belt conveyor, which discharges to an inclined belt conveyor of the same type (shown in diagram in *Figure 3*, and in outside view, in *Figure 1*), running up to the washing plant. A close up of the inclined conveyor is shown in *Figure 9*. This is a 30-in. wide belt conveyor, about 250 ft. long, operating at a speed of 360 ft. per minute, at an incline of 19 degrees. It carries 4½-in. ore screenings at a rate of 420 (*Continued on page* 978)

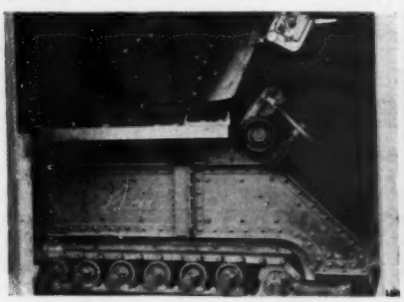


Figure 7—One of the three 30-in. wide cast steel flat top apron feeders for 4½-in. iron ore screenings at 140 t. p. h. each, showing worm-geared operated slide gate for regulating flow to collecting conveyor underneath.

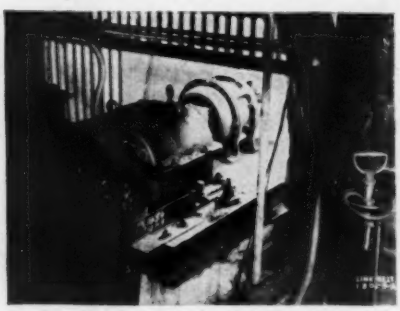


Figure 8—One of three 5-hp. Herringbone speed reducers and roller chain drive (in casing) to headshaft of apron feeders at the ore screening plant.

Figure 9—Looking down 30-in. inclined anti-friction belt conveyor handling 4½-in. iron ore screenings at 420 t. p. h. to Symonds disc crusher in washery building.

MECHANIZATION REPORT NO. 29-5

Operating Factors in CONVEYOR MINING

By G. B. SOUTHWARD

A discussion of conveyor mining, with sketches and graphs showing factors which determine the schedule for the operating cycles and the tonnage produced.

CONVEYOR mining has operating problems which are entirely different from those encountered with loading machines. The mine car transportation is one of the most important phases in a mechanically loaded mine and the success is to a large extent measured by the efficiency of the gathering haulage. Our two preceding mechanization reports analyzed the different haulage factors with respect to their effect on the tonnage production of a mechanical loader and showed the advantages of having the proper balance between the capacity of mine cars, time of changing single cars at the machine, and the time delay between gathering trips. The preparatory work of cutting, drilling, and shooting for mechanical loading and the nonproductive work of laying track and setting timbers are as important as the transportation, but because the machine is a mobile unit there can be a sufficient number of working places under development for all mining operations to be performed at the same time in separate places without interference.

In a conveyor operation the situation is quite different. A conveyor unit is not mobile and its operation is necessarily confined to one working place for comparatively long periods. In this type of mining the mine car transportation is, of course, important, but it appears to lose its importance because of its easy solution. A conveyor unit provides a stationary loading point where cars can be loaded in a trip. This simplifies the transportation in that it automatically eliminates gathering haulage and makes continuous loading possible. Delays between trip deliveries can be reduced to a minimum by properly scheduling the main-line haulage, and there should be no appreciable delay between single car placements at the conveyor discharge point.

In mining either with mechanical loaders or conveyors the main problem is to keep the loading unit working and to reduce or eliminate the time that this equipment is idle, but the procedure for attaining this end is entirely different with each type of equipment. Mechanized mining requires a concentration of the working places and the operations must necessarily follow a rigid schedule in order to maintain a proper balance between all of the factors. In mechanical loading this scheduling and balancing must be applied to the mine car placement through the gathering haulage. A conveyor operation requires the same degree of coordination, but instead of applying to transportation it must be applied between the cutting, shooting, dead work, and loading at the working face.

Conveyor mining is not measured by the mechanical efficiency of the equipment. If a conveyor has a capacity of 40 tons per hour or 320 tons per shift, it is being used at only one-third efficiency if 100 tons are loaded out in eight hours, but this refers only to the mechanical performance of the equipment and does not refer to the operation as a whole. To illustrate this it is simply necessary to point out that a long face with a 30-ton per hour conveyor running fully loaded during an entire eight-hour shift would not necessarily have its efficiency reduced by using a 60-ton per hour conveyor running only half full. In this case the mining from a labor efficiency standpoint might be theoretically perfect and this operating efficiency would not be affected by the fact that the capacity of the equipment was out of line. On the other hand, a conveyor may be operating at its full rated capacity and giving a 100 percent mechanical performance but might easily be the cause of retarding production and reducing the labor efficiency of the entire operation.

From an investment standpoint a conveyor unit should produce as large a tonnage as possible, and if this were the main consideration it should be loaded at maximum capacity at all times. From an operating viewpoint there may be several reasons why this can not be done economically, and it is rather essential at times to have a certain amount of extra carrying capacity to prevent spillage during a temporary loading peak. It is therefore clear that the carrying capacity of the equipment should be determined by the operating requirements of the mining system rather than to attempt to reverse this and make the operation conform to the capacity of the conveyor. There are now on the market such a wide variety in the types and capacities of conveying equipment that the selection of the proper unit for any given set of requirements should not be difficult.

In any system of conveyor mining there is one similarity—while the preparatory or dead work is being done in a working place the conveyors are idle and no coal is being loaded. Every conveyor operation, therefore, is carried on a continuous cycle, and each cycle is divided into two periods—productive and nonproductive. During the productive period of a working face coal loading is usually the only work that is done and the time for this period is determined by the number of men employed on the loading crew. However, there is a maximum limit to the number of men which can be used to load out a working face, and any employment beyond this limit will result in overcrowding without increasing the loading rate or reducing the time for a clean up. In the nonproductive period several different classes of work must be done—cutting, drilling, timbering, shooting, moving the face conveyor forward, and extending the haulage conveyor. Two or more operations can be performed at the same time. For instance, while the machine is cutting across the face the haulage conveyor can be extended, and also while the face is being drilled the timbers can be set. All operations, however, can not be performed at once and, as in the loading period, the time required for the nonproductive work is limited to a minimum which the employment of additional men will not reduce.

Conveyor mining as now practiced may roughly be divided into three general methods. The first is where the working place is comparatively narrow, as in a room, and where only one room is being mined so that all operations are performed in a continuous cycle and several clean ups are made during a shift. The second type is where there are two working places in close proximity so that while one face is being loaded the preparatory work can be done on the other. The third type is in long-face mining where the loading may be confinede to one shift with the preparatory and dead work on the other shift.

Figure 1 shows a method of long-face mining which is but one of several modi-

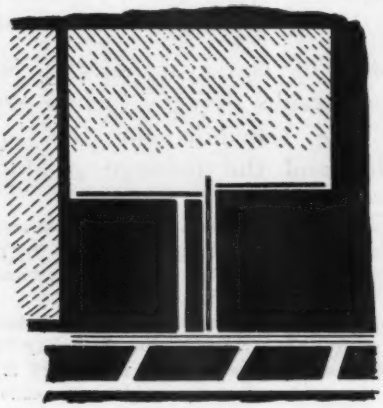


FIGURE 1
Conveyor Mining Plan for a Double Long Face Operation.

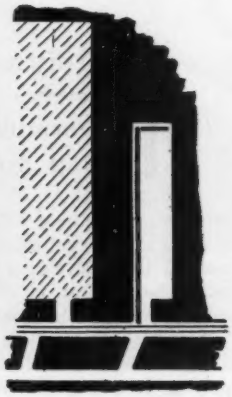
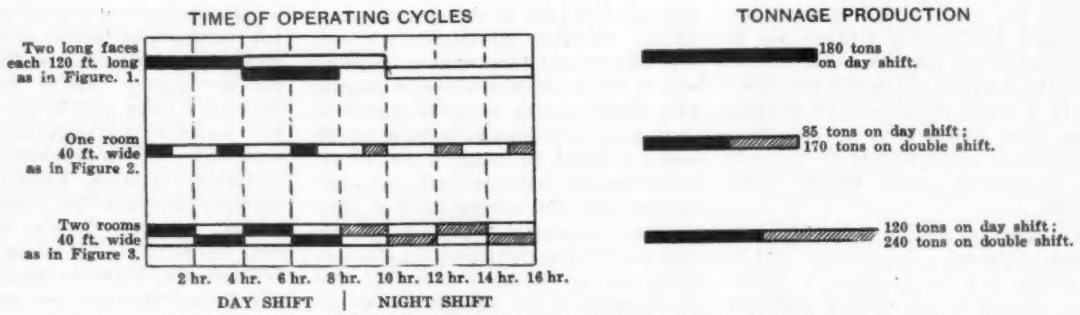


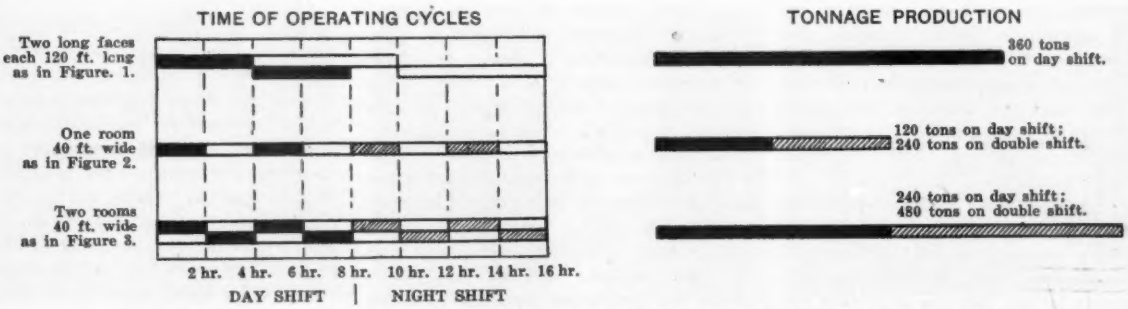
FIGURE 2
Conveyor Mining Plan for a Single Room Operation.

FIGURE 3
Conveyor Mining Plan for a Two Room Operation.



GRAPHS SHOWING OPERATING SCHEDULES AND TONNAGE PRODUCTION IN A 3-Ft. SEAM

Note—In these figures, solid black indicates loading on day shift, cross-shading indicates loading on night shift, and unshaded indicates non-productive period of cycle.



GRAPHS SHOWING OPERATING SCHEDULES AND TONNAGE PRODUCTION IN A 6-Ft. SEAM.

fications used. In this plan two faces are worked together with each face conveyor discharging into a single haulage conveyor which is laid down the entry to the mine car loading point on the panel haulway. In this system is is customary to confine the loading entirely to the day shift with the dead work starting some time after the loading and completing both faces by the end of the night shift.

Figure 2 shows a room and pillar method where only one room is worked at a time. A short conveyor is laid across the face of the room discharging onto a haulage conveyor which extends down the length of the room and loads into mine cars on the entry. In this type of mining there may or may not be a recoverable pillar left between adjoining rooms; in either case it will not affect the operating schedule shown. In this method all operations are performed in a continuous cycle and several clean ups are made during a working shift.

Figure 3 illustrates a two-room operating unit in which the arrangement of conveyors is the same as in *Figure 1*. There are two modifications of this idea now being operated; one where both rooms advance abreast and the pillar between them is recovered after they have driven to their limit, and another where one room is advanced while the pillar between the second room and the mined area behind is being recovered. In either mining method the same operating schedule will apply. An operation of this type provides the opportunity for carrying on productive and nonproductive work at the same time in different rooms with the loading crew in one room while the preparatory crew is at work in the other.

The number of cycles which are desired to be completed in a shift is to a large extent governed by the mining system. In a single room mining a quick clean up with a minimum time for each of the periods is more than likely to be the best method. Where two rooms are worked together it is desirable to complete as many cycles during a shift as possible, but the minimum time needed for either period automatically fixes the length for the other. Where one long face is worked it is customary to schedule this for one cycle in 24 hours with the loading on the day shift and the dead work at night. Where two long faces are worked together, the loading on both faces may be confined to the day shift, but in some mines both the day work and the loading are done on the same shift, alternating between the faces as in a double-room operation.

The question of determining what is the correct or the most economical length of time for each of these periods for any given working face is not one to which a quick answer can be given. There are a number of factors which all have some effect, and each one is involved with the other so that their proper coordination is rather complicated. The time required for loading out a face is fixed by the number of loaders employed, height of the seam, character of coal, and amount of partings. Under similar conditions the time of loading is not proportional to the length of the face as a long face will accommodate more loaders than a narrow room. The time required for the cutting, drilling, timbering, and other nonproductive work is also governed by the physical conditions, but as these several operations have to be performed in a certain sequence, the time for each is more or less proportional to the length of face where conditions are similar.

The proper scheduling for the cycle varies in different mining systems and the time graphs showing the operating schedules for each of the mining plans in *Figures 1, 2, and 3* do not illustrate any actual operations but are designed merely to illustrate some of the questions which must be considered in order to obtain a proper balance between the productive and the non-productive periods. For the purpose of making a general comparison between the three mining systems some arbitrary figures have been used which are not intended to represent actual operating practices. For instance, it is assumed that the preparatory and non-productive period will require two hours' time in a 40-ft. room as shown in *Figures 2 and 3* and that this same amount of time will be required for the 40-ft. length of face in the system shown in *Figure 1*. Whether or not this would be the case depends on the number of men in the non-productive crew and none of these graphs indicate any comparison between the number of men employed or the man-hours per ton of coal produced.

The first set of graphs show the operating schedule and the tonnage productions with each of these systems operating in a 3-ft. seam of coal. In *Figure 1* the operation is scheduled so that two faces will be loaded out during a day shift and the entire cycle for both faces will be completed in 16 hours. On the basis of two hours for a 40-ft. face length, the nonproductive time for both faces will require 12 hours. This means that the first face must be loaded out in four hours time. A 120-ft. face in a 3-ft. seam of coal with a 6-ft. undercut will produce 90 tons. This fixes the loading rate at 22½ tons per hour, and both faces in an eight-hour shift will produce 180 tons. In the room and pillar operation in *Figures 2* and *3* each room is 40 ft. wide and produces 30 tons of coal per cut in a 3-ft. seam. The time for the nonproductive work in each room is taken at two hours. In the single-room operation in *Figure 2* the loading should proceed at as fast a rate as possible and it is assumed in the graphs that this can be loaded out in one hour at the rate of 30 tons per hour. A cycle will be completed in three hours, making a production of 85 tons for the day shift or 170 tons if the operation is carried continuously on a double shift. In the two room operation in *Figure 3* the loading time should be made equal to the nonproductive time or 2 hours for the room clean up. This fixes its loading rate at 15 tons per hour and this operation would produce 120 tons on the day shift or 240 tons on the double shift.

The lower set of graphs show the same operating rates applied to a seam of coal 6 ft. high. In each operation it is assumed that the time for the dead work will remain the same as in the 3-ft. coal since this is not affected by the seam thickness. The loading rates, however, will be considerably changed. In the long face operation and in the two room operation, more men can be placed for loading than were required for the 3-ft. seam, and in these two systems the time for the cycle is not changed but loading rate and the tonnage is increased. In the single room operation, in *Figure 1*, the loading rate for the 3-ft. seam was assumed to be the maximum, and in the 6-ft. seam, therefore, the loading time will be twice as long. The comparison between the two sets of graphs shows that with the double room or the long face operation the tonnage increases proportionally with the height of the seam while in the single room operation this increase is not maintained.

The graphs on the opposite page are plotted to show a comparison between the number of operating cycles and the tonnage produced in two eight-hour shifts with each of the mining plans shown in *Figures 1, 2, and 3*. These graphs are theoretical in that they are designed to make a comparison of possibilities between the mining systems rather than a comparison of actual mining operations. As nearly as could be done, all operating factors were put on a common basis in each of the systems in order that the comparisons would apply to the hours required for the productive and nonproductive periods of the cycle and to the tonnage loaded, and these graphs do not represent a comparison of the man-hours employed or the amount of equipment used.

In each system a period of two hours is assumed as the time required for the non-productive period for cutting, timbering, etc., in a 40-ft. room and also for a 40-ft. length of the long face. In each system the time for the productive period is balanced against this and the loading rate set according to the tonnage of the working face.

COAL

NEWELL G. ALFORD
Editor

Practical Operating Problems of the Coal Mining Industry

The BANNING AERIAL TRAMWAY of the Pittsburgh Coal Company

By FRED C. CARSTARPHEN *

Requirements for tramways to carry 5,000 tons per day to two preparation plants unusual—The plans, simple in design, prepared by company's staff and largely assembled from standard equipment—Two unusually efficient angle stations described

THE story of the construction of the Champion preparation plants of the Pittsburgh Coal Company can not be told concisely. The enterprise was a bold one, both in its conception and in its execution.

Now that the work is finished, and the reverberation of its rapid-fire progress diminishes, some observations may be made of it. It seems clear that a new day dawns in the bituminous coal industry, possibly a step nearer the goal of using such methods as the low temperature distillation or "hydrogenizing" of the mined surplus of coal into products that may be stored and sold conveniently. At any rate, the consumers' demand for quality coal is met on so grand a scale that the work may be designated as "pioneering with a vengeance." The art of washing bituminous coal has advanced toward perfection in these plants.

Aerial tramways were needed to transport about 5,000 tons of coal per day to Champion Preparation Plants Nos. 4 and 5, located at the Warden and Banning No. 1 mines, respectively. When compared with the usual aerial tramway, these are to be classed as "extra strong." This is in keeping with the coal industry's need for the most sturdy and rugged types of equipment obtainable. Machines that have a place in ordinary industry seem to be inadequate in the coal fields.

The proposals of several aerial tramway manufacturers were canvassed and the equipment offered was deemed to be unsuited for the proposed service. The engineering department prepared plans and specifications and the materials and machinery were purchased in the open market. There was no hesitation in doing this, for all of the needed parts are simple in design and construction; in fact, the greater part of the equipment of an aerial tramway may be assembled from standard sheaves, bearings, bolts, etc., that have become a commonplace in many industries. It is certainly cheaper to buy them at the source than through a manufacturer acting as a jobber.

FIGURE 3. *Loading terminal of the aerial tramway with tipple of Banning No. 2 mine*

* Consulting Engineer, Denver, Colo.

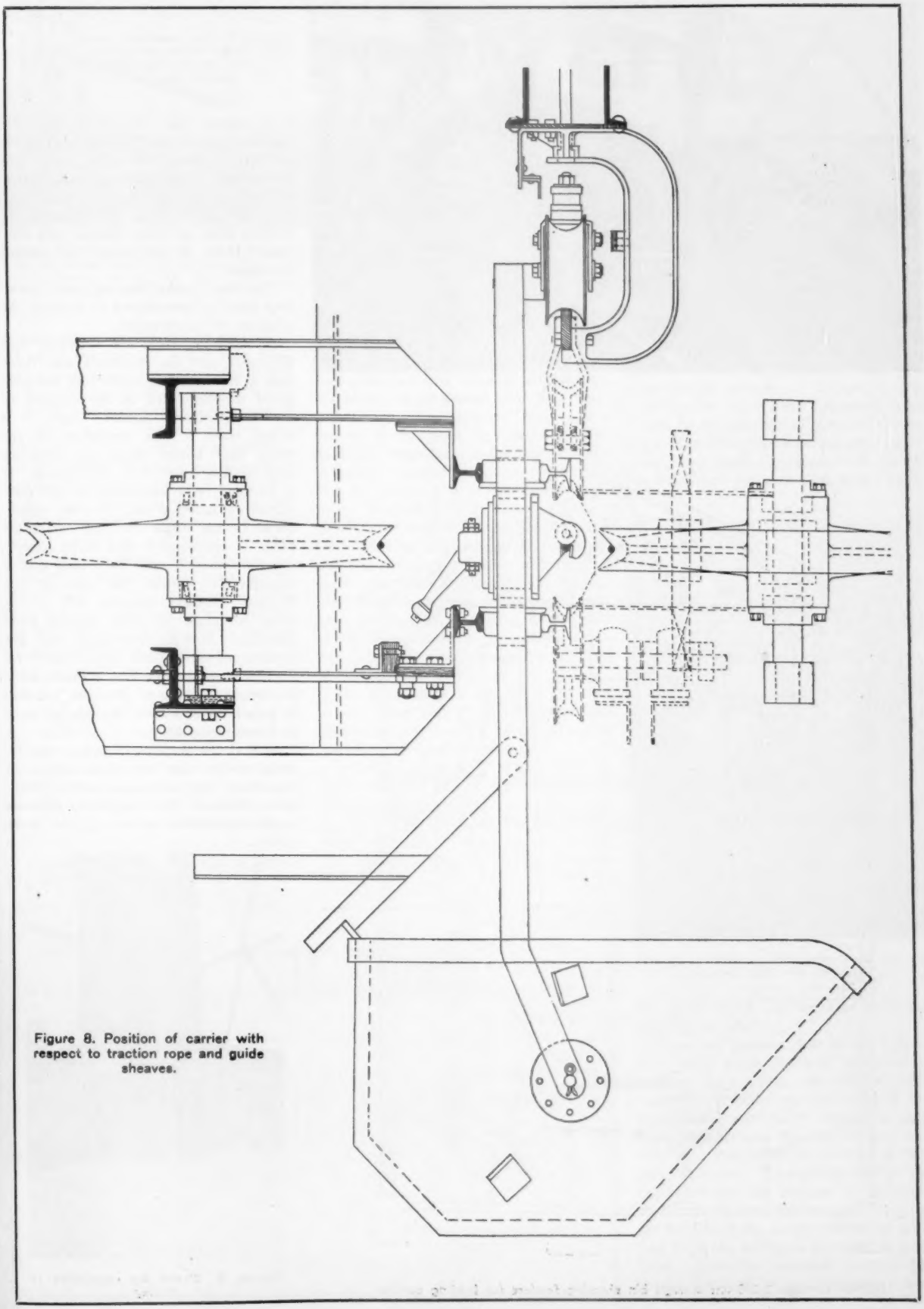


Figure 8. Position of carrier with respect to traction rope and guide sheaves.

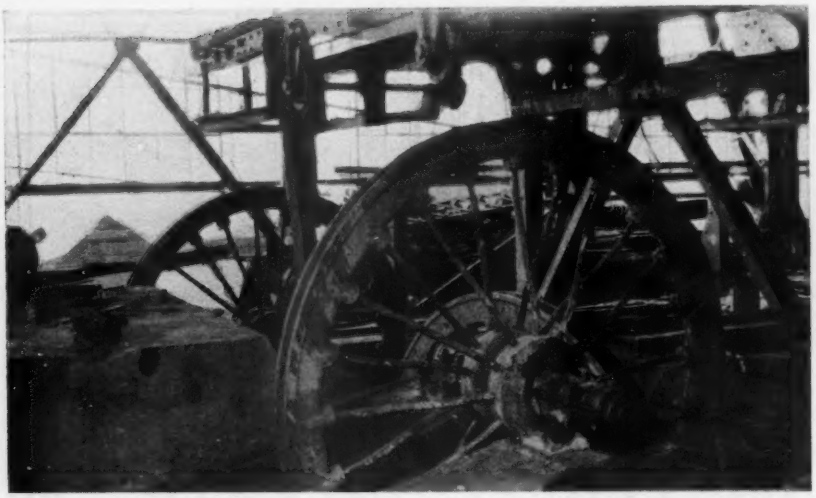


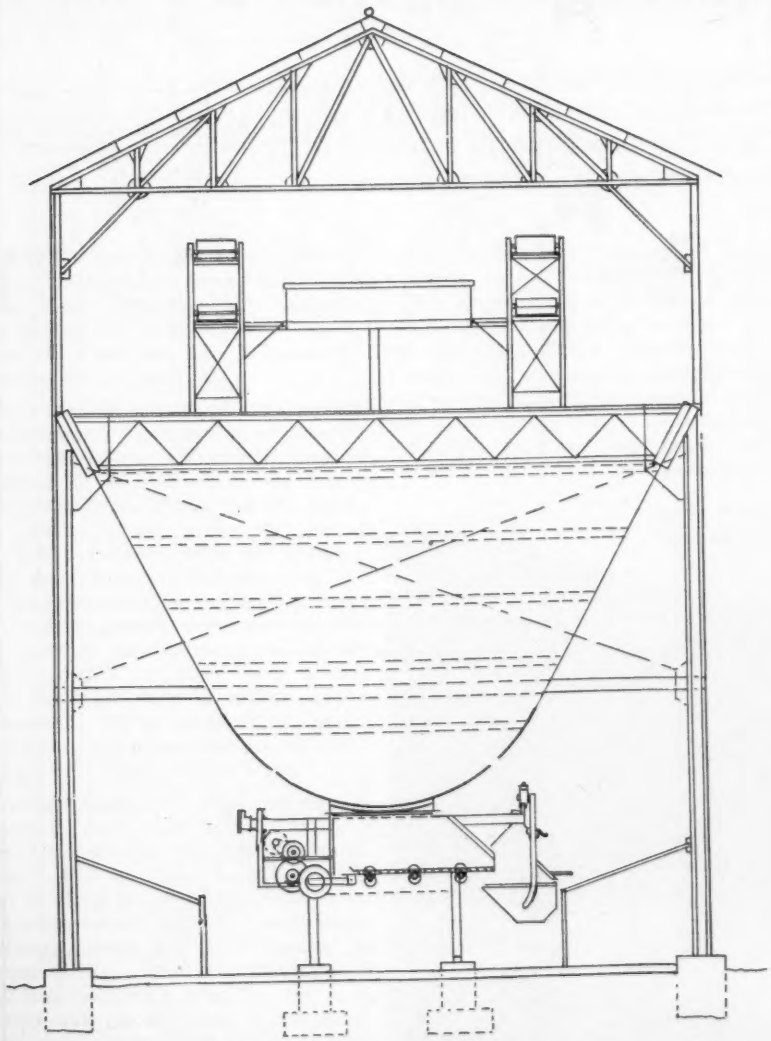
FIGURE 2. *The combined track cable anchor block and traction rope guide sheave foundation at loading terminal*

Procuring the equipment was the easiest part of the problem. The obstacles of location required sober consideration. Since the engineering and operating departments could enter into free discussion, it is believed that the studies were far more detailed and complete than if intrusted to outside interests.

The story of the Banning aerial tramway may be summarized to indicate the progress of construction.

In January, 1928, the tramway was discussed, and the discovery was made that a straight line connecting the proposed terminals fell in the channel of the Youghiogheny River. There is a belief, more or less prevalent, to the effect that aerial tramways must be built in "bee lines" to be economical. It is founded on a knowledge of the difficulties encountered and the costs engendered in the angle stations heretofore used. A challenge to this belief became insistent when it was discovered that a straight line joining the ends of the Warden tramway likewise fell in the river, although 15 miles distant from Banning. It was determined that the location of both lines should have an angle station, but one that would be more efficient than those of the past. It will be seen later how near this resolve came to accomplishment.

At first the Banning tramway was located on the west side of the river. It crossed a deep depression called Wickhaven Hollow. This hollow is a break in the formidable barrier of the bluffs



Section through 1,250-ton storage bin showing feeders for loading carriers

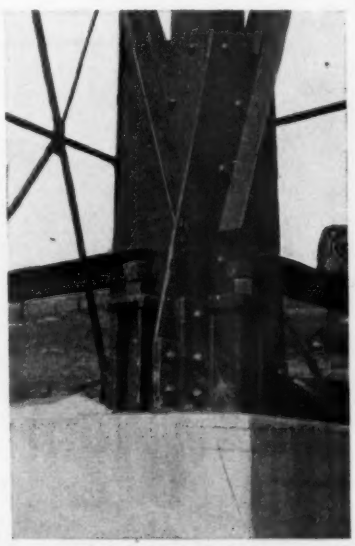


FIGURE 5. *Tower leg connection to footing*

FIGURE 4. *Southerly crossing of B. & O. R. R. tracks protected by suspended guard screen carried by four 1½ smooth coil cables*

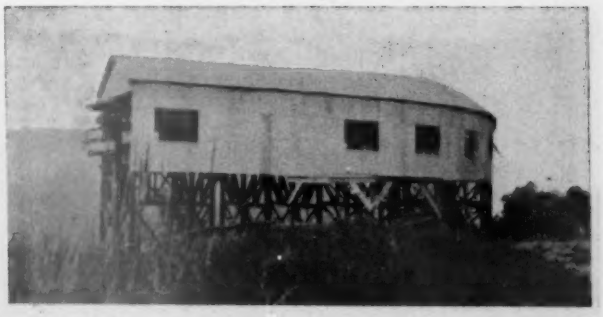


FIGURE 6. *Angle station of 53 degrees*

on this side of the river, and contains a branch of the railroad, a township road, and a coal camp. At first the angle station site was to be on the south side of the hollow and then it was moved to the north side. The negotiations for rights of way continued for eight months, and the location was abandoned in favor of a line that twice crosses the Youghiogheny River, and the main line of the Baltimore & Ohio Railroad, three important highways, and skirts the east limits of the town of Banning, Pa. In spite of the apparent difficulties at the outset, this location proved to be better than the one abandoned, thus establishing the wisdom of the company's decision to build its own tramways.

The design of the tramway was the simplest element of the problem. It could be altered to meet the demand of any situation foreign to the control of the company. River, highway, and railroad crossings are not to be taken lightly, neither are gob piles when used as sites for important structures, but each in turn were brought under control. For instance, *Figure 1* is a study of the cross section of the loading terminal bunker of 1,250 tons, together with its housing and loaders for the tramway carriers. The bin is 65 ft. long and is supported upon a double row of columns on 13-ft. centers, the inner ones carrying a load of 150 tons. The front of the terminal is a simple structure 30 ft. wide by 36 ft. long used for the cable anchorages and the tramway mechanism. The nature of the anchor block and foundation for the traction rope guide sheaves is indicated in *Figure 2*. Because of limitations of the site, the bin is located parallel with the river bank and the center line of the tramway is turned 58 degrees to the right. *Figure 3* shows the completed structure. The front bent is on the crest of the bank, and the string of gondolas is behind it, to bar any retreat. The tipple of Banning No. 2 mine and the conveyor gallery are also shown. Due to the pull of the cables entering the loading terminal it must withstand a horizontal load of 190,000 lbs.

The river span is 560 ft. to the first support, and 300 ft. more reaches the suspended guard screen over the B. & O. Railroad, as shown in *Figure 4*.

It will be interesting to note that the cable supports are of steel and are so framed as to indicate a Fink truss stood on end. This gives a very substantial structure with a minimum of weight. The leg connection to footing is shown in *Figure 5*.

The angle station is located 4,040 ft. from the loading terminal. Here the tramway carriers are automaticly deflected through an angle of 53 degrees. Such a change in alignment may be visualized by reference to *Figure 6*. An angle station has always presented difficulties to the passage of a carrier having a four-wheel carriage and an underhung grip. Such a carriage is shown in *Figure 7*, and has a beneign effect upon

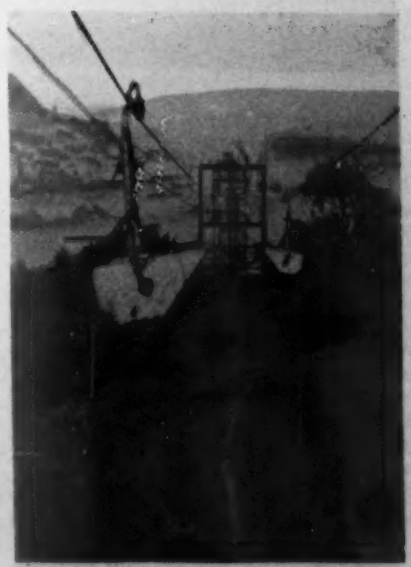
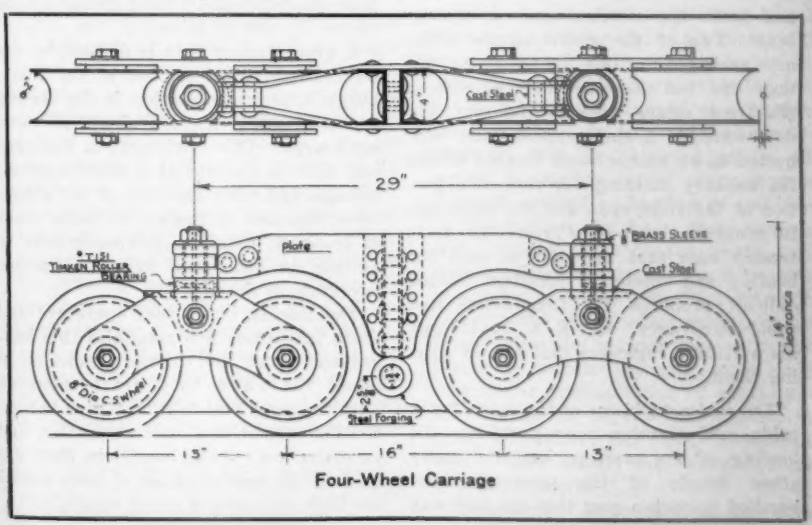


FIGURE 9. *View of line from angle station toward discharge terminal*

the track cables as compared with the two-wheeled variety.

When the carriers pass to the outside of a large angle, the grip jaw only is between the traction rope and its guide sheaves, but when on the inside of the angle the hanger and its underhung grip must pass between the traction rope and sheaves. Inspection of *Figure 8* will make this clear. The dotted lines on the right indicate the position of the traction rope, carrier, and sheaves when on the outside of the curve; the inside position is to the left and is shown in solid lines. Here the traction rope is displaced about 20 in. and imposes a load



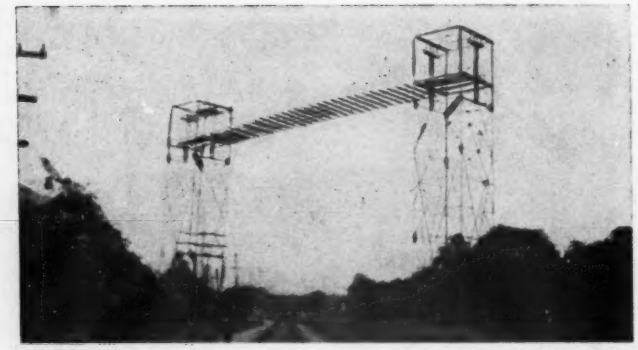


FIGURE 10. *Suspended guard bridge over B. & O. R. R.*

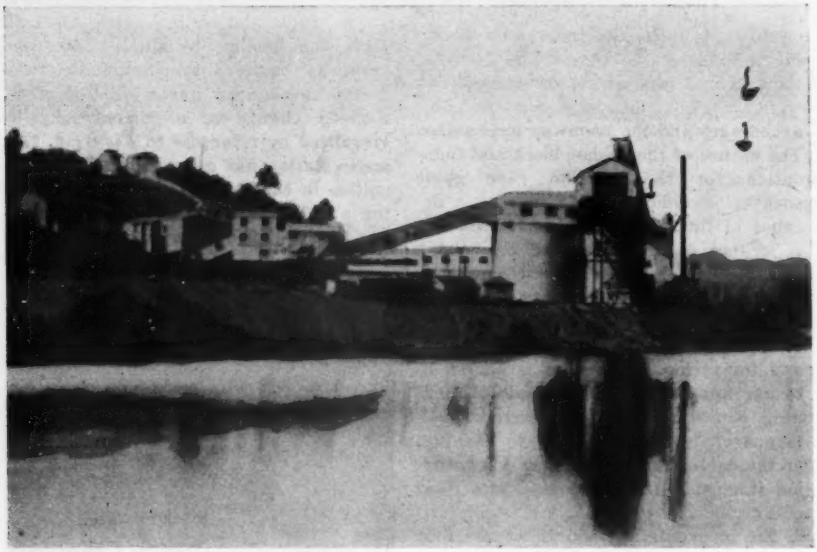


FIGURE 11. *View of river span, discharge terminal and storage bins at Champion Preparation Plant No. 5*

of more than 4,000 lbs. on the hanger. This load is handled by converting the hanger into a truck having four wheels that run on T rails mounted on the surface of a vertical cylinder, and so supported and spaced as to provide a suitable channel for the closing lever of the grip.

Every 30 seconds loaded and empty carriers roll through this station at a speed of 500 ft. and more per minute.

The line slopes downward from the angle station toward the river, as shown in *Figure 9*.

The highways were guarded by steel bridges. It has a span of 60 ft. and carries a deck made of heavy wire mesh, and a mattress of 1⅛-in. diameter galvanized strands.

Between survey stations 9 and 10 the line again crosses the Baltimore & Ohio Railroad. This crossing is protected by a suspended guard bridge, as shown in *Figure 10*. To develop such a structure, calculations must be made as though for an imposing suspension bridge. The design of both of these guards was complicated by the necessity of carrying the cables across the river to an anchorage. The length of the suspender rods were easily determined from the fact that the second differences of the deflections are equal. (See paper 1454 of the American Society of Civil Engrs.)

The cables cross the river with a span of 850 ft. and enter the discharge terminal at an elevation of about 90 ft. above the water surface of the river. This terminal is situated upon an old gob pile, and spans the circular concrete storage bins. Two of the guard screen cables are anchored to this structure at the floor line, but the other two, as well as the track cables, pass to the rear and downward to a single anchor bar connected to an anchor block located within the washery building. A view of a portion of the river span and the discharge terminal is shown in *Figure 11*. It is readily seen that the sites of both the loading and discharge terminal offered difficult problems for foundations and cable anchorages. Mr. E. S. Taylor and his assistant engineers did well in solving them.

The easier problems of the drive, track cable, and traction rope positions, the loading of the carriers, and the many other details of the tramway were handled in such a way that the line was placed in service in August, 1929, on a 20-hour-per-day schedule, and has fulfilled the expectation of its design.

NEW METHODS IN SCREENING IRON ORES

(*From page 970*)

tons per hour. A weightometer is installed at the lower end of this belt conveyor, and it is here that a careful check is made on all of the ore passing into the washer building, as from these weights the royalties on the mined ore are paid.

This 250-ft. inclined belt conveyor is driven by a 60-hp. motor, direct connected to a worm-gear speed reducer. A gravity take-up is installed near the discharge end of the conveyor. The conveyor discharges into a conical screen with 1¼-in. round perforations.

The oversize from this screen is hand picked on a picking belt conveyor, 36 in. wide and about 12 ft. long. From this point the ore left after picking discharges into a 4-ft. diameter Symonds cone crusher, and from the crusher to a Dorr-Davis 4-rake unit and bowl classifier. From there the washed ore is discharged from the rakes into railroad cars for shipment to the dumping piers at the head of the Lakes.

The oversize rock from the screening plant is discharged into rock cars which are taken out on a waste rock dump for discharging.

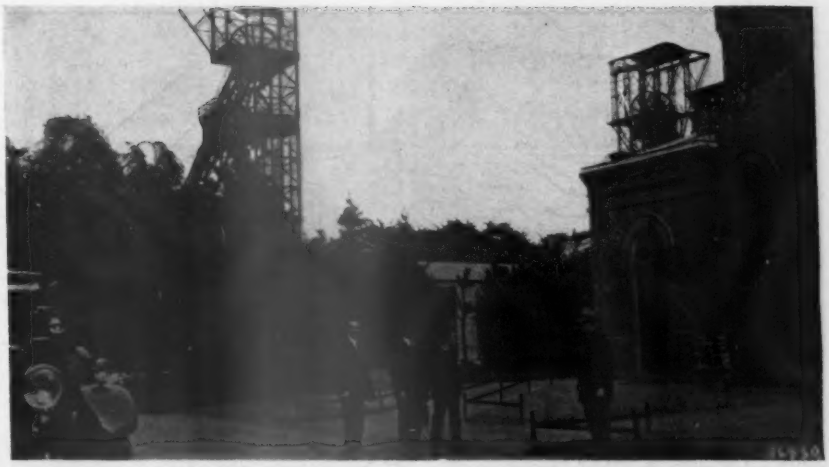
This is the first iron ore screening plant of its type ever installed on the iron range. It has come up to the expectations of the most optimistic, and already has set a new standard for iron-ore screening equipment.

HAZARD FROM SUBNORMAL VOLTAGE IN MINES

A warning against overlooking the hazard from subnormal voltage in gassy and dusty coal mines is addressed to safety engineers, state mine inspectors, mine operators and others, by the United States Bureau of Mines.

A great deal of time is devoted by the Bureau's electrical section, at the Pittsburgh Experiment Station, in the testing and developing of safe electrical mine equipment. This equipment is designed and built to operate at a predetermined voltage, and when the user of the equipment, because of neglect or false ideas of economy, requires such equipment to operate at subnormal voltages, trouble is certain to develop.

The Bureau hopes that operators and State Inspectors will recognize this hazard and watch the voltage conditions in mines for which they are responsible with the same zeal that they give to ventilating currents and that where they find excessive low voltage conditions they will be just as concerned as if they found too little air along a gassy entry.



The Gottfried Wilhelm Colliery, Ruhr Coal Field

By PROF. DR. FR. HERBST *
and DR. C. H. FRITSCHE †

Mechanization of GERMAN MINING

Mechanization should reduce cost, decrease accidents, and make better working conditions—Advantages of concentrated mining are of importance in the densely populated Ruhr District—Longwall mining with back filling is the predominating system in Germany—Shaking and chain conveyors used with hand loading—Pick mining not yet extensively replaced by machine cutting—Tables showing production figures in the Ruhr district

A GENERAL preliminary survey of the progress made in German coal mining seems useful in answer to the following questions:

(1) What is meant by mechanization?

(2) What is to be accomplished by mechanization?

(3) What are some of the difficulties faced by mechanization in German mining?

The first question might seem superfluous, but it is not; because, on the one hand, the idea of mechanization varies at different times and in different countries; for instance, in American mines it refers generally to the use of loading machinery, while in other countries it has a much wider meaning. On the other hand, it can not, of course, be extended to underground mining where human labor was long ago replaced entirely by machinery; that is, to conveying in the shafts and main galleries, to the drainage system and ventilation. In the term "mechanization" we shall include the use of all equipment which replaces or assists human labor by machinery to mine coal and to convey it between the working place and the main conveying level. In consequence, mechanization may also mean the further penetration of machinery from the principal conveying places to the extreme ramifications of the mine.

But even this does not quite dispose of the matter. We have considered "mechanization" and "operation by machinery" as one and the same thing. But may not mechanization be still more aptly defined as the "use of mechanical power," so that by substituting this mechanical power with directly acting natural forces, the result will be a further progress over "machinization"? Viewed in this light, may not, for instance, an apparatus for moving the coal by belts to a pit arranged as a bunker, from which it is removed by another conveyor belt, be regarded as an advance in mechanization, as compared with the method of hauling in coal cars at the farther end by a small locomotive, braking them in the shafts, and then moving them away by a large locomotive? And does not the bucket elevator in the shaft, which greatly facilitates filling the buckets from a bunker served by a belt conveyor, mark progress in the mechanization of shaft-hauling operations beyond its "machinization," so that, in this case, "mechanization" really means the "simplified use of natural forces"?

Considering these factors, the question with regard to mechanization should therefore be formulated thus: "To what extent has German coal mining succeeded in replacing human labor by the simplified use of natural forces in all underground mines where large machines have been in use for so long a time?

On a closer consideration, the second question, even as all others, appears to be more complicated than at first sight. According to what has been stated, the question may be reduced to this form: "Why eliminate human labor?" The most ready answer is this: To cheapen operation, the cost of which mounts as wages increase, by replacing expensive human labor with natural forces. In fact, no particular explanation is required to show that with every wage increase the border line between human labor and mechanical force automatically shifts in favor of the latter and that mechanical means now come in for consideration, whereas formerly there had been no occasion to do so.

But the machine offers advantages other than those of direct economies. Machinery decreases the risk of accidents by decreasing the number of persons exposed to them. We can not but agree with American experts who, in connection with the relatively high number of fatal accidents in underground mining, point out that, in this respect, the figures which deserve most consideration, namely, the number of lives sacrificed to mine a given quantity of coal, are more favorable in the United States than in Europe, because of the thorough mechanization of American mining. Besides all this, the use of machinery also means a considerable decrease in the number of accidents: the mine locomotive decreases many risks of accidents,

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United States Bureau of Mines Photo.

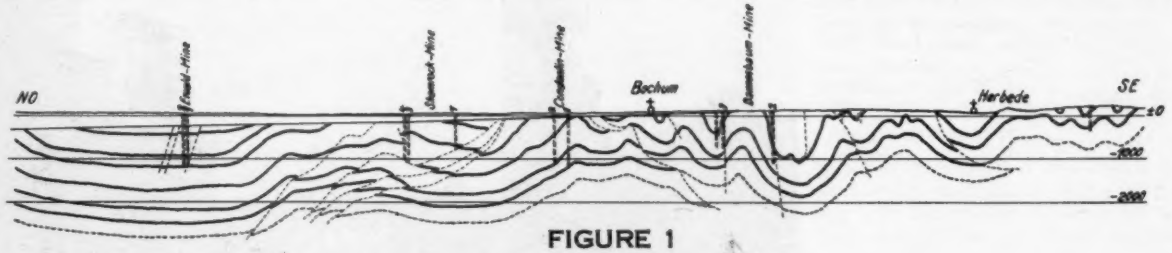


FIGURE 1

CROSS SECTION OF THE RUHR COAL DEPOSITS

such as the bruising of the fingers and toes of the former trammer; however, it is not all clear gain, because the locomotive has created new sources of accidents. The loading device decreases the period during which the miners are at work at the most dangerous point in the mine, etc. Incidentally, machine mining works faster, thus decreasing the danger from falling rocks, which increases in proportion to the length of exposure to the roof. Accident prevention is best indicated by the equipment which is of the simplest sort: belt and bunker conveyance is much safer than transportation by locomotive and winch; filling in the excavated spaces with the waste of the mine by means of compressed air is much safer than by hauling in tipping-wagons and hoisting by bucket elevator in the shaft, as regards loading, is much safer than transporting by wagons.

In addition, consider the relief to the miners from heavy bodily labor, by reason of the use of machinery. In fact, machinery, in this respect, benefits humanity much more than many legislative measures in the interest of social welfare. There is no need to insist on this matter. "Flesh and bone should not be forced to carry burdens that can be borne by steel and iron." The more machinery is used in underground work, the more difficult will it become for mining companies to secure competent employes, as the more intelligent persons will seek work in places where they find the most agreeable working conditions.

Again, the reduction of the number of underground workers, by reason of the use of machinery, will also decrease some of the difficulties connected therewith: the task of finding living quarters is greatly simplified, the transportation of the gangs to and from the mines is reduced, fluctuations in the size of gangs, controlled by business conditions, are decreased, and the danger of accidents arising from the employment of untrained personnel in times of increased deliveries is also lessened.

Finally, by adding to their mechanical equipment, mining companies work to their own advantage, to some extent, because the greater activity of machinery, and therefore, mining industries as well, increases their sales market and helps in part to compensate for the cost of the machinery.

As regards the third question, that is, the special difficulties faced by the mechanization of German mining, the best answer may be found by comparing working conditions in the German bituminous coal mines with the extremely favorable working conditions of American mining. The extensive ground movements, which have especially affected the Ruhr coal deposits (see the cross section in Figure 1) have not only, to a great extent, converted the large and uniform working areas of the American seams into many single and uniform working wings with a relatively small face area and decreased extraction capacity, but have also led to many broken galleries, so that transportation from the working front to the main level must often be performed in horizontal drifts, cross cuts and blind shafts. Moreover, these movements have caused great unrest throughout the range, causing fissures and subjecting it to a more or less dangerous degree of strain. This condition, because of the constant precautions needed to guard against falling rocks, offers great difficulties to the setting up and operation of auxiliary machinery. Then there is the great accumulation of coal. To assure an adequate hauling service, this condition requires almost simultaneous work on numerous single seams and, therefore, the neighboring seam must always be worked very carefully. Consider also the great depth—averaging about 600 meters—which has already been reached in our mining; it represents, where machinery is used, a constant threat and uncertainty, because of the great pressure exerted in the form of horizontal and vertical displacements, cross cut contractions, etc. The following working conditions, so desirable where machinery is to be used, are therefore absent: wide working-area, concentration of the output at a few points and safe machinery installation. Finally, reference should be made to the frequent impregnation of our coal with slate and rock, which requires special attention in machine mining and hauling, as well as to the lesser firmness of Ruhr coal as compared with American coal. This lesser firmness means that all coal where size is of importance must be handled with special care; this interferes with machine mining, particularly because a too close disintegration makes it difficult to eliminate the impurities mentioned, during the dressing, thus entailing considerable washing-waste.

Another factor of great importance is the intensive building up of the densely populated Ruhr district, due to the concentration of the coal resources on a relatively small area of only 6,000 sq. kms. This condition induced the Ruhr coal mines, since the beginning of the present century, to abandon the former method, that is "Bruchbau" (working by single short stalls along the down-beaten roof of the old workings) and to adopt the "Abbau mit Bergeversatz," that is, the pack-wall mining system. As a result, mechanization has to face new difficulties: the advantage it offers, that is, the rapid mining made possible under favorable formation conditions, frequently can not be utilized because packing can not be performed with sufficient speed. Besides, conveying is seriously hampered because it is constantly necessary to watch out for the wagons approaching the coal wall from the opposite direction. Therefore, the uniform conveying movement advantageous to mechanization can not be achieved. Most of all, these facts also mean a serious obstacle to the use of shaft elevators in place of the platform system.

Another circumstance which directly influences the nature and possibility of mechanization is the thickness of the seams. In the Ruhr district, this thickness averages only 1.35 meters and varies between 0.40 and 2.50 meters.

The problems and extent of mechanization also vary according to the inclination of the seams, which, as already stated in detail, differs considerably because of the folds and faults which have particularly affected the Ruhr coal deposits. According to Table 2, 56.5 percent of the Ruhr coal is mined from seams with inclinations of from 0 to 25° (flat inclination), 27 percent from seams with an inclination from 25 to 55° (medium inclination), whereas 16.5 per-

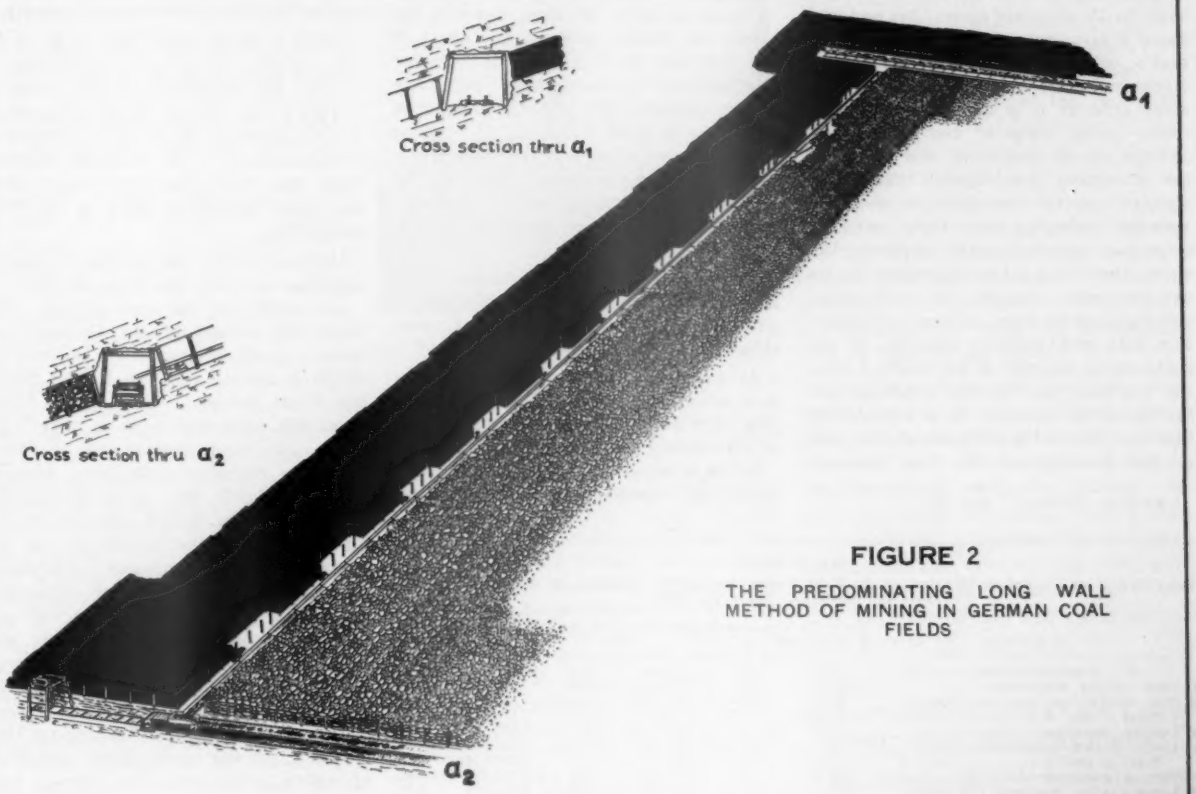


FIGURE 2

THE PREDOMINATING LONG WALL METHOD OF MINING IN GERMAN COAL FIELDS

cent is obtained from seams with inclinations of from 55 to 90° (steep inclination).

The mining method that predominates in Germany, especially in the Ruhr district, is the long wall system, which, in particular instances, is subject to many changes. Figure 2 serves as an illustration; a_1 and a_2 are in the direction of the seam, that is, level running working-faces, of which the upper a_1 serves as a gallery leading to the deposits and the lower a_2 as a gallery for loading and removing the coal. The coal formation located between them is worked in panels either along the seam, downward or on the rise, and the excavated space is filled in with waste material. This filled space follows the wall of coal as it is worked at a distance of from 2 to 3 panels; that is, from 3 to 4 meters. In the same manner as for the wall of coal at the working-front proper, the long-wall, that is, the headway, is generally driven forward several meters. The same method can be applied to backward cutting (Rückbau), with the difference that the working-faces must be entirely moved ahead (250-300 meters long and more), and only then can the actual working begin in the long-wall. This backward cutting is but little in use in the Ruhr district; but it may be taken for granted that it will become important in the near future.

The chief difference between long-wall mining on the level and mining in a steep deposit consists in the remoteness of the working-faces or, in other words, in the width of the coal seam located between them, in the height of the long-wall. For a level deposit, the height of the long-wall may be much greater than for a steep deposit, where, out of consideration for the safety of the coal digger, to prevent the formation of dust and not to damage the coal, narrow limits have been established. For a level deposit, the height averages about 100 ms., but may be increased to 200 ms. or more, whereas, for steep deposits it averages only 20 ms.

Mechanization, according to the inclination of the seams, may be extended to various working methods. In level seams, the mining, the long-wall extraction, and the loading of the long-wall conveyor can be mechanized. In partly steep and all-steep seams, however, only the actual winning can be mechanized, as in such seams the coal, because of its weight, rolls from the working-face to the loading place into the hauling wagons, for seams sloping from 25 to 35°, when use is made of sheet-iron chutes placed on the floor.

A word now about the mechanization for coal-getting. An illustration of this operation is seen in Table 1*, which shows not only the status of mechanization in 1927 but also its development in the years 1925-1927. This table shows that by far most of the mining is performed by picks; that is, 74.3 percent, or 87.7 million tons by pick only and another 5.3 percent or 6.24 million tons by picks in combination with coal-cutting machines of varying construction types. Another 3.17 percent, or 3.73 million tons are mined by cutting machines in combination with manual labor and blasting, and the remaining 17.23 percent without the use of any machines, and only by manual labor and blasting. The nature of the coal-getting therefore differs in three essential points from that used in the United States and also in Great Britain: first, in the predominance of the pick; second, relatively slight use of the cutting machine; third, but slight resort to blasting.

The wide use of the pick is due first of all to its unique adaptability to the varying nature of the mining conditions in the Ruhr district, also to its reliable nature and small purchase and operation costs. The latter, including a 50 percent depreciation, amount to only about 0.60 to 0.90 M. per working day. In most cases, the coal can be mined by the pick without any preliminary cutting by machine. Consequently, cutting by machine

* Wedding, "Glückauf," 1928, page 731.

is generally done when the coal is too hard for the hammer alone (gas and gas-flame coal); that is, chiefly for flat deposits, to which the use of the cutting machine is, as a rule, restricted. In steep deposits it is used only in exceptional cases, because, due to the low ceilings of the longwalls, and the number of miners per longwall, the so restricted use of the machine does not warrant investing the high purchase price and operation costs involved. Besides, there are other objections to its use for safety reasons. In most cases, cutting-machine work is done in conjunction with pick work or blasting, as the coal-cutting machine is not really a mining machine, but merely prepares and facilitates the mining. It is noteworthy that the limit of usefulness of the pick in flat deposits, as the coal becomes harder, is reached somewhat earlier than in steep deposits. In steep deposits, the miner can further increase the effect of the pick with the weight of his body and is often able to use a heavier pick than in flat deposits. For this reason, it is necessary to make wider use of blasting in flat seams than in steep seams, in which latter, not to damage the coal and the walling, we would much prefer to avoid blasting. Hence, we have the following facts:

In flat deposits picks are mostly used, along with manual labor and blasting to quite some extent; the coal-cutting machine is but little used.

In semi-steep deposits, the pick predominates; manual labor and blasting play only an unimportant part; the use of the cutting machine is limited.

In steep deposits, the pick again predominates; manual labor and blasting come in to a limited extent and the cutting machine is eliminated entirely.

Table 2 shows these differences in detail; divided according to inclinations, it reports the quantities of coal produced in 1927 by the various kinds of machines. It also shows the share of the production corresponding to the various machines from flat, semi-steep and steep seams and their respective share in the total production.

Table 3* shows the number of mining machines in use in the Ruhr district.

So much for the coal-getting. For about 85 percent of the German coal mined, another operation is involved which is unknown in the United States and Great Britain: the complete filling in of the excavated pockets with mine waste. In steep seams, this operation offers no technical difficulties; because of its weight, the waste is readily dumped into the hollow spaces from the dumping-place. But in flat seams, the packing presents greater difficulties. This operation is still performed mostly by manual labor, which means not only high costs but also loss of time and slows up the working of the coal wall considerably. In Upper Silesia the packing material (sand) is often washed in with water (the flushing-packing method). Owing to the great quantities of water which must be pumped into and then out of the mine, and because of the uncertain conditions besetting the region, this method has not been introduced and, consequently, is resorted to only in exceptional cases. But of late

* Wedding, "Glückauf," page 732.

TABLE NO. 1

Quantities of coal mined in all mines in the Ruhr District by various machines, as well as by manual labor and blastings. Years 1925-1927

Nature of mining	Quantities of coal mined 1925 Tons	Pct.	1926 Tons	Pct.	1927 Tons	Pct.
1. Post cutting machines	1,356,362	1.3	785,345	0.7	294,984	0.25
2. Post cutting machines and picks	626.013	0.6	673,153	0.6	519,173	0.44
Total 1 and 2	1,982,375	1.9	1,458,498	1.3	814,157	0.69
3. Cutting machines	1,147,691	1.1	1,234,113	1.1	672,565	0.58
4. Large cutting machines	5,634,121	5.4	4,263,301	3.8	2,761,059	2.34
Total 3 and 4	6,781,812	6.5	5,497,414	4.9	3,433,624	2.92
5. Cutting machines and picks	1,043,356	1.0	897,537	0.8	1,274,351	1.08
6. Large cutting machines and picks	2,086,711	2.0	4,263,301	3.8	4.448,373	3.77
Total 5 and 6	3,130,067	3.0	5,160,838	4.6	5,722.724	4.85
7. By picks only	38,082,482	36.5	63,388.546	56.6	87,748,583	74.36
8. Other machines	104,336	0.1	56,096	0.1	38,937	0.03
By machines exclusively	50,081,072	48.0	75,561,392	67.4	97,758,025	82.85
By manual labor and blasting	54,254,494	52.0	36,630,727	32.6	20,235,970	17.15
Total	104,335.566	100.0	112,192,119	100.0	117,993,995	100.00

TABLE NO. 2

Quantities of coal mined in 1927, according to the different formation groups, by the various coal mining machines, as well as by manual labor and by blasting

Nature of mining	Quantities of coal mined with the inclinations indicated: 0–25° Tons	Pct.*	Pct.†	Pct.‡	Over 25–55° Tons	Pct.*	Pct.†	Pct.‡	Over 55–90° Tons	Pct.*	Pct.†	Pct.‡	Total Tons	Pct.†	Pct.‡
1. Pillar cutting machines	256,638	0.39	88.37	0.22	28,767	0.09	9.91	0.02	5,020	0.03	1.72	0.004	290,425	100.0	0.25
2. Pillar cutting machines & picks	327,899	0.49	63.39	0.28	165,474	0.52	31.99	0.14	23,929	0.12	4.62	0.02	517,302	100.0	0.44
3. Cutting machines	3,058,168	4.60	89.28	2.61	340,763	1.08	9.95	0.29	26,300	0.13	0.77	0.02	3,425,231	100.0	2.92
4. Cutting machines & picks	4,918,374	7.41	86.36	4.19	753,057	2.39	13.22	0.64	23,777	0.12	0.42	0.02	5,695,208	100.0	4.85
5. Picks	43,944,738	66.18	50 29	37.40	26,658,631	84.54	30.51	22.69	16,772,383	85.79	19.20	14.28	87,375.752	100.0	74.36
6. Other machines	6,734	0.01	17.21	0.005	11,203	0.04	28.63	0.01	21,195	0.11	54.16	0.02	39,132	100.0	0.03
By machinery generally	52,512,551	79.08	53.95	44.70	27,957,895	88.66	28.72	23.80	16,872,604	86.30	17.33	14.36	97,343,050	100.0	82.85
By manual labor & blasting	13,892,116	20.92	68.95	11.82	3,577,169	11.34	17.75	3.04	2,678,878	13.70	13.30	2.28	20,148,163	100.0	17.15
Total	66,404,667	100.0	.....	56.52	31,535,064	100.0	.....	26.84	19,551,482	100.0	.....	16.64	117,491,213	100.0	100.0

* Share of quantity of coal mined from the same inclination (net production).
† Share of quantity of coal generally mined by the machinery referred to or by manual labor and blasting (net production).
‡ Share of total production reported (net production).

TABLE NO. 3

Average annual number of coal mining machines on hand in all mines in the Ruhr District in the year 1913 as well as in the years 1925-1927

Kind of machines	1913 In operation	1913 Auxiliary	1913 Total	1925 In operation	1925 Auxiliary	1925 Total	1926 In operation	1926 Auxiliary	1926 Total	1927 In operation	1927 Auxiliary	1927 Total	Increase or dec'se, machines in oper'n 1926 over '25 %	Increase or dec'se, machines in oper'n 1927 over '25 %
1. Picks	217	47	264	41,309	3,384	44,993	45,299	5,522	50,821	64,428	5,717	70,145	+13	+56
2. Cutting machines—usual and large sizes	15	2	17	971	285	1,256	703	370	1,073	544	439	983	—29	—45
3. Pillar cutting machines	265	29	294	866	237	1,103	574	267	841	421	352	773	—34	—51
4. Rotary drilling machines	37	3	40	2,618	748	3,366	1,977	641	2,618	1,700	473	2,173	—24	—35
5. Drilling picks	11,656	661	12,317	36,502	6,663	43,165	33,104	6,055	39,159	33,559	6,220	39,779	— 9	— 8
6. Shogging chute motors	1,922	278	2,200	7,175	2,223	9,398	6,461	1,938	8,399	6,571	2,041	8,612	—10	— 8
7. Length of cables of shogging chutes—kms	121	1	127	398	*	*	*	*	*	346	*	*	*	13

* Not considered.

another process has taken form: water is replaced by compressed air at an excess pressure of from 0.7 to 2 atms. By this process, waste material from 0 to 80 mms. in size is forced into the hollow space. Various centrifugal and ballistic machines have also been constructed to force packing material into such spaces.

Hauling the coal mined out of the longwalls is a mechanization task in flat deposits only: this has been briefly discussed elsewhere in this article. In nearly all cases, this is done through shaking chutes. Conveyor belts are likewise being used in connection with this method. But the use of these belts presents special difficulties. As a rule, conveying machines serve not only to haul away the coal, but also to bring in the packing material. The simultaneous removal of the packing material at several points by a large gang doing the hauling is easier with a chute than with a belt. In most cases, it is also easier to move a chute than a belt. As a whole, it may be stated that about 80 percent, that is, about 55 million tons, of the quantities of coal mined from flat seams are conveyed by mechanical means (chutes). The remaining 20 percent are mined by headway work, by driving galleries, or by other mining methods for which chutes are not used. The total length of the chutes used in the Ruhr district amounts to 322 kms.

While hauling of the mined coal is performed by machinery, the mechanization of the loading work is still an unsolved problem. Portable loading machines can not be considered for longwall mining, especially when the seams are of small or medium thickness; but clam-shell loaders, self-loading conveyors and scraper loaders may well be used. So far no machinery of this kind has been adopted and the chute is still loaded entirely by manual labor. The adoption of the machines named is faced by special difficulties because in Germany the working-fronts must be walled much thicker than in the United States and, to some extent, also in Great Britain. The rows of props are placed only from 1 to 1.50 meters apart. The distance between the props belonging to the same row is the same or a little less. Another circumstance unfavorable to the use of loading machines lies in the nature of mining by picks. Loading machines require a large quantity of loose coal to be on hand. With our present means, this can be accomplished only by coal-cutting machines or by blasting, whereas, with the use of the pick, only a small quantity is mined at a time and promptly loaded; that means mining and loading work constantly alternate with each other during the same shift.

Contrary to practice in the United States and Great Britain, a mechanical

Preussengrube Colliery, Upper Silesia, Germany.

device to convey the coal discharged from the chute to the wagons or by the belts at the working-faces (such belts are already widely used), is not needed in the Ruhr district in most cases. In the United States and Great Britain, the working-faces are formed by widening the roof of the seam. By this method, the coal must be loaded on the wagons or brought to the level of the belt by a gate-end loader. In long-wall mining in the Ruhr district and also in other German coal districts, it is customary to widen the footwall of the mining front, so that, as a rule, the chute will discharge from a height which enables the direct loading of the wagons.

The reason why the preceding paragraphs dealt mainly with the Ruhr district is, as may be noted from the following table, because that region is by far the largest and most important German coal mining district.

GERMAN COAL PRODUCTION IN 1927

	Tons
Ruhr district	117,994,000
Upper Silesia	19,378,000
Saar district	13,194,000
Lower Silesia	5,844,000
Aix-la-Chapelle	5,023,000
Other districts	5,360,000

Mining in the Ruhr justly deserves to be considered as representative of German coal mining. The mining districts of Lower Silesia, Aix-la-Chapelle and the Saar are very similar to the Ruhr coal region as to deposit conditions and the thickness of their seams. Because of the nature of the mining in these districts, its mechanization can be very closely compared with mechanization in the Ruhr. The chief difference lies only in the degree in which mechanization is practiced. However, many of the mines of Upper Silesia are faced with conditions different from those in all other German coal mining districts. These conditions resemble in many ways those found in the soft coal mines of the United States, that is, thick flat deposits predominate in both countries. Mining in Upper Silesia is done mainly by blasting. Cutting machines are not used. The coal is still loaded on the wagons by manual labor, in spite of the fact that in view of the great thickness of the seams, loading by machinery in Upper Silesia seems to be more practicable than in any other German mining district. But it is true that among other difficulties the thick walling of the working-faces and the short distance between the posts also hamper the use of the loading machines now employed so successfully in the United States.

There is no doubt that the mechanization of loading is one of the next problems of German coal production. Most probably it will also be solved by changing the present method of mining. In this connection, we would observe that the pick is not a machine, but merely a mechanized tool, that mining today still requires considerable manual labor and that the machine still plays a relatively small part in this operation.

COAL-WASHING LABORATORY PROVIDED WITH NEW EQUIPMENT

The installation of a pneumatic coal-cleaning table at the Northwest Experiment Station of the United States Bureau of Mines, Seattle, Wash., is the latest addition to the equipment of the coal-washing laboratory at that station, and makes it one of the most completely equipped in the country for conducting studies of coal-washing problems. The table was installed by the College of Mines of the University of Washington in Mines Laboratory, which is maintained by the university and used jointly by the College of Mines and the Bureau of Mines.

The dry cleaning installation is flexible and consists of an adjustable-rate apron-type feeder, a continuous-bucket type elevator for circulating middling, full-size table and extra decks, table fan and exhaust fan, and gauges for measuring the air volumes. A variable speed drive is used for the table and elevator. The elevator may be used either for returning the middling to the feed or for recirculating the entire table feed during the adjustment period.

The principal types of wet and dry cleaning apparatus are now represented in the equipment of this laboratory, including complete float-and-sink tanks, screens, full-size coal washing tables, one-and two-compartment jigs of the Luhrig and Elmore types, classifiers, sand flotation machine, sludge tanks, elevators, and accessory equipment.

U. S. Steel Buys Columbia Corp.

Directors of the United States Steel Corporation voted October 31 to acquire the Columbia Steel Corporation for approximately $46,630,000 in common stock.

The purchase of Columbia Steel, the largest steel producer on the Pacific coast, is the biggest expansion step by the Steel Corporation in a number of years.

Negotiations for the Columbia corporation were started early in the year, and after numerous rumors it was announced in July that an option had been sold. At that time it was said the basis for the purchase would be $200 for each share of United States Steel Corporation stock to $17 for Columbia Steel.

In announcing the option had been exercised, James A. Farrell, president of the corporation, said the step had been determined "after an extended and exhaustive examination, inspection and study of the properties and their possibilities.

"The growing demand for steel of various kinds in Pacific coast territory," said Mr. Farrell, "and the greater demands of customers for improved service, make it desirable that the corporation have its own producing plants located there."

The Columbia Steel Corporation was incorporated in 1922 as a consolidation of the Columbia Steel Company and the Utah Coal and Coke Company. In 1923 it acquired the Llewellyn Steel Company, of Los Angeles, and later the Milner-Dear-Lerch iron holdings at Iron Mountain, Utah. Three years ago the Pacific Sheet Steel Corporation was acquired.

The company's plants are located at Pittsburgh, Calif.; Torrance, Calif.; Portland, Oreg.; and Ironton, Utah.

Fire Destroys Mill at Dome Gold Mine in Ontario

The mill of the Dome gold mine, one of the first to be constructed in the Porcupine Field, Ontario, was destroyed by fire the night of October 28 with a loss estimated at $1,500,000, fully covered by insurance. After a desperate battle of two hours, the machine shops and other equipment, representing another half million dollars in value, were saved. Mine production will be shut off for a while, but no time will be lost in repairing the damage. However, a larger staff will be available for opening up the property, and with this in view it is expected that special attention will be given to mine development.

Lake Iron Ore Movement Heavy

Shipments of Lake Superior iron ore by lake boats in October totaled 7,989,127 gross tons, compared with 8,453,952 gross tons in October, 1928, and with 9,547,040 gross tons in September of this year. This is a decrease of 464,825 gross tons from October shipments a year ago or 5.50 percent. However, it was a substantial tonnage for an unusually stormy month and, with a total of 61,253,954 tons shipped by the end of October, this year will assuredly establish a new record for lake shipments, both for war and peace times. The increase over last year's shipments for the season at the end of October this year amounted to 11,534,023 gross tons or an amount 23.20 percent greater than went down the lakes by boat to November 1, 1928.

Pickands, Mather to Merge With By-Products Coke Co.

Pickands, Mather & Company, of Cleveland, blast furnace interests are to be merged with those of the By-Products Coke Company, of Chicago. The deal involves water front properties in Toledo, Ohio; Erie, Pa., and Duluth and represents about $40,000,000, based on the present market value of By-Product stocks. The capital stock of this concern is being increased from 800,000 to 2,500,000 shares of no-par common stock of which 1,200,000 will be used in the acquisition of the Toledo Furnace Company, the Perry Iron Company and the Zenith Furnace Company.

Set Date for 1930 Convention of Lake Superior Safety Section

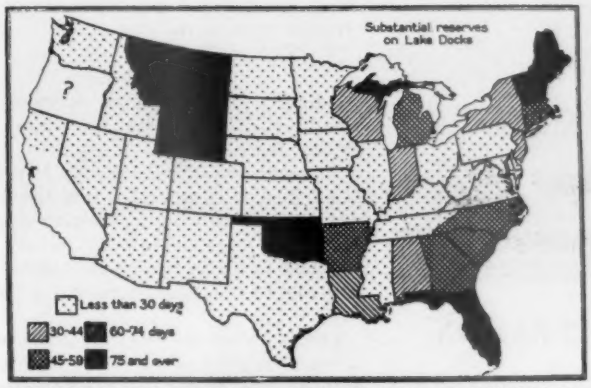
A meeting of the Executive Committee of the Lake Superior Mining Section of the National Safety Council was held in Duluth October 25, to make certain arrangements looking to the 1930 annual convention, which will be held in Duluth. The date of the convention was fixed for June 26 and 27, Thursday and Friday, at Hotel Duluth. The committee discussed the program for the convention in a general way, and a number of special features calculated to stimulate interest were suggested. The committee will meet again December 20 in Duluth, at which time papers and speakers will be determined on. Durant Barclay, of Coleraine, is chairman, and J. P. Victor, of Stambaugh, Mich., is secretary of the Executive Committee. Other members are G. J. Barrett, F. S. Crawford and E. W. R. Butcher, Duluth; W. H. Carrick, Bessemer, Mich.; S. J. Cicotte and L. C. Moore, Hibbing; Albert Mendelsohn, Painesville, Mich.; E. R. Trengove, Wakefield, Mich.; B. D. Shove, Ironwood, Mich.; and A. C. Borgeson, Chisholm, Minn.

Mackay School of Mines Gets Valuable Technical Library

One of the great handicaps the Mackay School of Mines has had heretofore is the lack of literature on desert formations and Paleontology, particularly the work that has been done in countries outside the United States. Recently the library of Dr. Johannes Walther, of Halle, Germany, was offered for sale. Dr. Walther, originally a paleontologist, was led in the course of his studies, to the questoin of the formation of the deserts of the world and became, through his knowledge of the arid regions of the earth, the greatest authority on the subject. During the 60 years of his activity the foremost geologists of the world exchanged papers with him so that his library covers practically all branches of the science. It is especially rich in papers on the formations of deserts and the recent geological periods, as well as many of the older monographs on paleontology and fossils that are almost impossible to obtain in any other way except by picking up one of these older libraries.

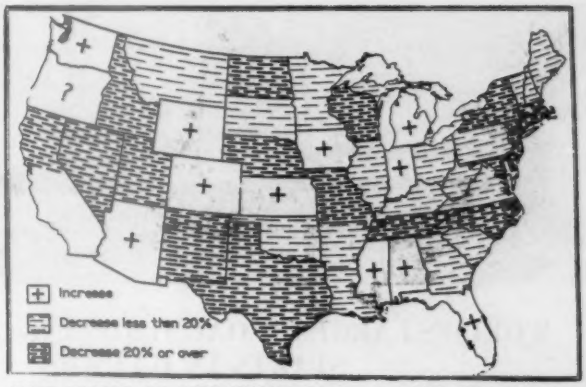
When Mr. Clarence H. Mackay learned that the school library was deficient in material of this sort, he very generously arranged to purchase the Walther library for the Mackay School of Mines, in furtherance of his plan to give the school every facility possible to place it in the forefront of mining educational institutions.

The library is composed of between 6,000 and 7,000 paperspublished within



DAYS SUPPLY OF BITUMINOUS COAL ON HAND AT GENERAL INDUSTRIAL PLANTS (OTHER THAN STEEL AND COKE WORKS) OCTOBER 1, 1929

At rate of consumption prevailing in August and September, industrial plants had coal enough to last 32 days on October 1. Reserves varied widely in the different states. New England had average of 66 days supply, while industrial plants in Northern Peninsula of Michigan were also heavily stocked with coal, but over most of the country reserves were moderate for this season.



HOW STOCKS OF BITUMINOUS COAL AT INDUSTRIAL PLANTS ON OCTOBER 1, 1929, COMPARED WITH THOSE ON THE SAME DATE A YEAR AGO.

In comparison with the same date last year the stocks of bituminous coal held by industrial consumers (other than steel and coke works) have been reduced by more than 10 percent over the country as a whole. The accompanying diagram shows that with the exception of Southern Michigan, Indiana, Iowa and a few scattered states in the West and South the decrease has been nearly countrywide, with many of the states showing reductions of more than 20 percent.

Survey of Commercial Stocks of Coal

Commercial stocks of bituminous coal used largely for industrial purposes amounted to 37,500,000 tons on October 1, 1929, compared with 41,100,000 tons on October 1, 1928, and with 33,100,000 tons on July 1, of this year, according to the quarterly survey just completed by the United States Bureau of Mines.

Exports during the third quarter of 1929 averaged 410,000 tons a week against 342,000 tons in the previous quarter and 399,000 tons during the same period of last year. The weekly rate of home consumption during the third quarter amounted to 8,713,000 tons a week as compared with 8,651,000 tons in the previous quarter. Compared with the corresponding quarter of last year, the current rate of home consumption shows an increase of 5.7 percent, reflecting somewhat improved business conditions.

In addition to the stocks in the hands of consumers there were 9,896,825 tons of bituminous coal on hand on the docks of Lake Superior and Lake Michigan on October 1, 1929, as compared with 6,629,262 tons on July 1, 1929.

Stocks of anthracite in retail yards on October 1 show the usual seasonal increase over the amount on hand three months ago, but are somewhat below the quantity held by the retailers on corresponding dates in other recent years.

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the past 60 years, including those of the last year or two. As it is especially rich in the problems of semi-arid regions it will be a great aid in the study of the problems of this state.

Mining to Be Represented in Chicago's Century of Progress

The representation of mining and metallurgy will assume an important role at the Chicago Century of Progress celebration in 1933, according to Dr. M. M. Leighton, chairman of a group of scientists appointed by him to study methods by which mining and metallurgy can be most effective exhibited at the fair.

Dr. Leighton, who is chief of the Illinois State Geological Survey Division at Urbana, is one of 40 members of the National Research Council's science advisory committee which has been asked to develop a basic theme whereby the Century of Progress celebration may graphically depict the progress in all the sciences, both pure and applied, during the past hundred years.

The science theme will take the form of a panorama in which all the arts of display, including moving and talking pictures, moving models, pageants and authentic reproduction of inventions and discoveries, will be employed.

J. F. Robinson Dead

James F. Robinson, of Miami, Okla., president of the Commerce Mining & Royalty Company, died November 20 in Denver, Colo., where he had gone for his health about four months ago. He was 64 years old.

James F. Robinson

In the Tri-State Mining District Mr. Robinson was actively identified with every phase of the industry. He was the first president of the Tri-State Zinc and Lead Ore Producers' Association and held that office until failing health compelled him to take a less active part in its affairs. For several years he was a member of the board of directors of the American Zinc Institute, and in 1928 he was elected a member of the Board of the American Mining Congress.

How the Commerce Mining & Royalty Company, under his executive management, grew from practically nothing to a concern of magnitude is current history.

The firm of Sill & Root, Inc., Rush T. Sill, president, Lloyd L. Root, vice president, and L. F. Nicholas, secretary-treasurer, have established offices at 115 West Seventh Street, Los Angeles, Calif., for the carrying on of general mining business, including: mine examinations, geological studies, supervision of development and management of properties, general consulting practice, financing of proven properties.

Mr. Root, for many years, State Mineralogist of California, is well known in mining circles.

General view of the new tipple.

WORLD'S LARGEST COAL STRIPPING OPERATION STARTS IN ILLINOIS

THE greatest coal stripping enterprise in the world, involving the most modern and largest equipment of its kind ever built was formally started at the Fidelity mine of the United Electric Coal Company near Du Quoin, Ill., November 7.

Involved in this undertaking are two mammoth pieces of equipment through the use of which unusual results are expected. One is the largest shovel in the world, and the other is the largest and best equipped tipple ever built for the preparation of coal by the stripping method. Both of these, and also the other shovels used at the mine, are completely electrified with General Electric equipment, making the mine entirely electric in its operation, with the exception of the haulage equipment.

The Mine

The coal seam is Illinois No. 6, varying from 6 to 8 ft. in thickness, with an average thickness of 6 ft. 7 in. The company owns or controls sufficient coal tributary to this mine for 40 years of mining at the rate of 1,500,000 tons a year.

From the standpoint of size, equipment used, method of operation, etc., this mine is unique and has no equal in the world. As the coal seem is very deep in places, and is unusually thick, it was necessary to employ unusual methods and equipment to produce the coal within production costs current in other mines.

The stripping or open-pit method of mining used at this mine has been practiced for many years. The past few years however have seen a great development in this method principally because of the monster stripping shovels which are now available.

Coal is mined at the present time from three pits on the property. The stripping in No. 1 is handled by the large shovel and, in pits Nos. 2 and 3, by combination units each consisting of a Marion dragline and a Marion shovel, the draglines having 10-yd. capacity buckets and the shovels, 12-yd. capacity dippers. The dragline uncovers the top soil down to a predetermined depth, and then the shovel follows and finishes removing the overburden. Having greater range the dragline deposits its portion well out of the way of the shovel's range. It is the intention of the company to add a fourth unit in the near future, which will give the mine a monthly capacity of 175,000 tons. The rock overburden is "shot" with liquid oxygen produced by the company in its own liquid oxygen plant built by the Keith Dunham Company, of Chicago.

After the coal is removed and placed in mine cars, it is transported to the tipple, where it is cleaned and graded, etc., finally being loaded into railroad cars for shipment to the market. The mine is also equipped with four crushers. The entire output of the mine will be distributed through the Electric Coal Company and its branches.

The Large Shovel

All the shovels used at the Fidelity mine are products of the Marion Steam Shovel Company, including the large stripping shovel. The latter is by far the largest shovel in the world. Although designed primarily for use as a 20-yd. shovel, this excavator is used with a 15-yd. dipper, which allows an extension of the boom. This gives the shovel a greater reach.

Although the dipper capacity is rated 15 cu. yds., it is estimated that the dipper will hold 20 cu. yds., heaping measure. One scoop load of dirt would be sufficient to fill a trench 1 ft. wide, 6 ft. deep and 68 ft. long, or a room 7 x 7 x 8 ft.

The reach of the dipper is sufficient to place material about 85 ft. above the ground. The dipper has a pushing and lifting power of around 100 tons, which would easily be sufficient to lift an ordinary railroad car full of coal.

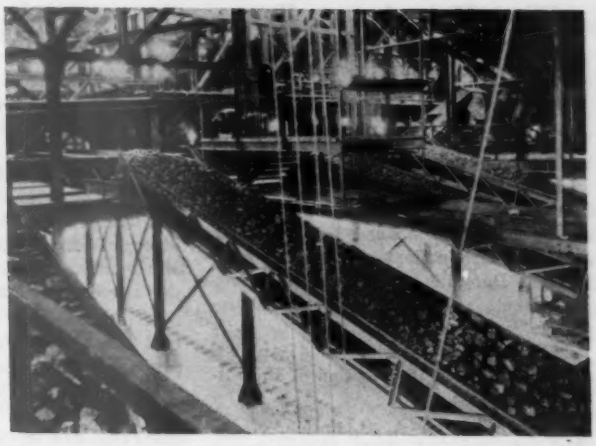
As speed of operation is essential, it is necessary that the shovel operate quickly. It takes a bite, dumps it and is back for another bite in less than a minute. The dipper, when moving around to dump at full speed, travels at the rate of about 20 miles an hour.

The complete shovel weighs approximately 1,600 tons. This is about twice as heavy as the largest shovel previously made. The deck of the shovel on which the electric machinery is mounted, is about 20 ft. above the ground, and measures 60 ft. long and 30 ft. wide, or 1,800 square ft. The highest point on the shovel is about 110 ft. above the ground.

The electric equipment on the shovel aggregates the equivalent of approximately 4,500 horsepower, but all the operations are controlled by one man. The control is of the variable voltage type, by means of which the generator voltage is varied by varying the generator field. This allows rapid maneuvering and quick reversing, and also limits the

The big shovel at work on overburden.

12-yd. shovel stripping; small shovel, in foreground, loading coal.



Loading booms, showing central operating platform in tipple.

torque to a definite safe value so that mechanical parts will not be subjected to undue strains or stresses.

Power comes to the shovel through a trailing cable approximately 3 in. in diameter, wound on a cable reel attached to the rear of the shovel. The power supply is alternating current at 4,000 volts. This drives a 5-unit motor-generator set consisting of a motor, three generators and an exciter.

The motor, which drives the other four units, is a 1,700-horsepower, 4,000-volt, 720-r.p.m. synchronous unit. One 860-kilowatt generator supplies direct current up to 800 volts for operating the hoist motors; two 350-kilowatt generators supply direct current up to 1,000 volts for operating the swing and crowd motors and a 50-kilowatt exciter supplies 125 volts, direct current, to excite the fields of all the motors and generators.

The hoisting motion is provided by two 450-horsepower, variable-voltage, heavy-duty, steel mill type motors operating at speeds up to a maximum of 500 r.p.m., the speed being variable to suit the nature of the work performed. Two 150-horsepower, variable voltage motors of the same type, with a maximum rated speed of 1,000 r.p.m., provide the swing motion, these also having variable speeds. A motor with a unique rating—100 foot-pounds-torque—operates the dipper trip, and two 3-horsepower, squirrel-cage, induction motors operate oil pumps. Power for driving the latter motors is supplied by small auxiliary transformers.

The Tipple

The tipple was designed and erected by the Jeffrey Manufacturing Company. It covers over 19,000 square feet of ground and serves seven railroad tracks. It has a rated capacity of 800 tons of coal per hour. This tipple embodies many new screening, mixing, loading and control features which provide an unusual degree of economy and flexibility of operation. The grading possibilities exceed anything hitherto attempted in tipple construction. Lump, 3 x 6 egg, 2 x 3 egg, Nos. 1, 2, and 3 nut and slack coal can be loaded on separate tracks simultaneously. When desired, any mixtures of these grades can easily be made.

The inclined conveyor gallery leading from the dump hopper to the preliminary crushing and picking plant is 15 ft. wide by 120 ft. long. The preliminary crushing and picking plant covers approximately 7,200 square feet, and the main portion of the tipple covers approximately 10,000 square feet. All tracks have limestone ballast. An interesting feature of the mine transportation facilities to the tipple is the 40-ton automatic drop-bottom pit cars, equipped with Timken roller bearings, believed to be the first to be used in strip mining.

The drop-bottom cars, on arriving at the tipple, are placed over a dump hopper and the coal is dumped automatically. The coal then passes through a plate feeder to a large scraper conveyor. From this it may be delivered either to the preliminary picking and crushing plant or to the main screens in the tipple. That coal which undergoes preliminary crushing and picking to remove sulphur balls is afterwards delivered to the main screens, also. After the main screening, the coal passes to the picking tables in the [illegible] where top coal and the remaining [illegible] are removed. It is then loaded into cars for shipment, and refuse is taken away and dumped.

The tipple is operated by 43 electric motors in ratings ranging from 3 to 150 horsepower and aggregating approximately 2,000 horsepower. Nearly all are 3-phase, 60-cycle machines, operating on 440 volts and, with but few exceptions are standard slip-ring induction motors. Most of the operating speeds are 900 r.p.m., although some are operated at 600 and 720 r.p.m., and two run at 1,800 r.p.m. Practically all are operated by magnetic control, utilizing push buttons.

Opening Ceremonies

The opening ceremonies took place at the mine on November 7. A total of approximately 1,000 guests were invited including executives and representatives of large coal companies, railroads, manufacturing companies, etc., and officials and representatives from the participating companies: The United Electric Coal Companies, the Electric Coal Company, the Marion Steam Shovel Company, the Jeffry Manufacturing Company and the General Electric Company.

All the equipment was in operation at the opening. The guests were transported by special trains from St. Louis and Chicago direct to the tipple, and were returned to St. Louis and Chicago by the same trains. A buffet lunch was served at the mine.

L. C. & N. to Transfer Coal Lands to New Company

Samuel D. Warriner, president of the Lehigh Coal and Navigation Company, has addressed a letter to the stockholders of that corporation, advising them that the directors have recommended that as a step toward the segregation of the company's properties it sell all of its coal interests to a corporation to be organized for the purpose of carrying on the coal mining business, for such consideration and upon such terms as may be determined by the board of managers. A proposition is also recommended that the capital stock of the company be increased to 3,000,000 shares of no par common stock from its present issue of 643,355 shares of $50 par stock, on the basis of three shares of new stock for each share of the present $50 par stock.

Illinois Mining Institute Meets

What was perhaps the most interesting and best attended meeting ever held by the Illinois Mining Institute, took place at Danville, Ill., on Friday, November 8, 1929. The arrangement committee in charge of David I. Rock, general superintendent, of the United States Fuel Company, at Danville, and the program committee headed by Harry M. Moses, superintendent of the same company at Danville, completed perfect arrangements and a very instructive program.

The business meeting held at 9.30 a. m., resulted in the election of the following officers:

President—Prof. A. C. Callen, of the mining department of the University of Illinois.

Vice President—Jos. D. Zook, president and commissioner of the Illinois Coal Operators' Labor Association.

Secretary and Treasurer—B. E. Schonthal, of B. E. Schonthal & Co., Chicago.

Routine business followed the election of officers, and after an adjournment for lunch the afternoon session opened at 2 p. m., with Prof. Callen, president, presiding.

Former president, John E. Jones, safety engineer of the Old Ben Coal Corporation, read a very interesting history he had prepared on the Illinois Mining Institute from its inception some 38 years ago. It revealed many unique ideas that have been experimented with in the practice of coal mining in this part of the country.

The first talk was given by B. R. Gebhart, public relations counsel of the Illinois Coal Bureau, on "Closer Relationship Between Coal Producers and Distributors."

An illustrated paper was presented by Cloyde M. Smith, research associate in mining engineering, University of Illinois, on "Some Recent Experiments in Mine Ventilation."

John R. Foster, superintendent of Orient Mine No. 2, of the Chicago, Wilmington & Franklin Coal Company, at West Frankfort, Ill., the largest bituminous coal mine in the world, read a very interesting paper on "Mechanical Mining."

The annual banquet was held in the evening at the Hotel Grier-Lincoln banquet room, with about 300 in attendance.

On Saturday, the entire membership of the Institute with their families, attended the Army-Illinois football game at Champaign, 32 miles from Danville, making a pleasant wind-up to a most successful meeting.

During the business meeting, quite a great deal of discussion was had on the proposed annual boat trip always taken by the Illinois Mining Institute each year, and suggestions were offered as to the most desirable points of interest to be taken on that trip. It was left, however, to the officers and executive committee to decide on just where the meeting would be held this spring.

Otis Mouser Dead

Otis Mouser, prominent coal operator and banker, died of pneumonia at his residence, 402 North Bowman Avenue, Merion, Pa., on November 7, following a three-weeks' illness.

Mr. Mouser was born in Kentucky, his first employment being as railroad telegraph operator. In 1896, he became connected with the Virginia Coal and Iron Company and the Stonega Coke and Coal Company, and in 1916, became operating vice president of both companies and their subsidiaries in Virginia.

Mr. Mouser moved to Philadelphia in 1923 as assistant to the late Colonel D. B. Wentz, and after the death of Colonel Wentz, in 1926, became the chief executive of the Virginia Coal and Iron Company, Stonega Coke and Coal Company, General Coal Company, Interstate Railroad Company, Whitehall Cement Manufacturing Company, Hazle Brook Coal Company and all their subsidiaries. He was also a director of the Corn Exchange National Bank and Trust Company, of Philadelphia, as well as the National Coal Association and American Mining Congress.

Mr. Mouser was a member of the Manufacturers Club, Racquet Club, Midday Club, of Philadelphia, and the Lonesome Pine Country Club, of Virginia.

He is survived by his widow, Mrs. Leila M. Mouser and one son, Otis, Jr.

Otis Mouser

Indiana Operators Meet

Forty coal operators representing 32 coal companies, attended the annual meeting of the Indiana Coal Operators' Labor Association at Terre Haute, Ind., November 19, afternoon and evening sessions being held. Homer B. Talley, president of the association, presided over the meeting. Following the regular routine of business, including the report of the activities of the organization for the last year by Harvey Cartwright, election of officers was held.

The members of the executive board for 1930 are as follows: Homer B. Talley, Terre Haute, chairman and ex-officio member; Charles Gottschalk, Evansville; John A. Templeton, Terre Haute; H. M. Ferguson, Clinton; Hugh Shirkie, Terre Haute, and W. J. Freeman, Terre Haute. The above mentioned members were reelected. J. R. Fenton, of the J. K. Perry Coal Company, Chicago, was the only new member to be elected to the executive board.

Charles O'Neill to Become Vice President of Peale, Peacock & Kerr

Charles O'Neill, of Altoona, Pa., who for nearly 12 years has been the secretary and treasurer of the Central Pennsylvania Coal Producers' Association, has resigned to become vice president in charge of sales of Peale, Peacock & Kerr, Inc., with headquarters at the general office of that company in the Graybar Building, New York City. He will also represent the affiliated Peale interests and will assume his new duties January 1, 1930. Mr. O'Neill, although a comparatively young man, has been identified with the coal industry in Central Pennsylvania for nearly 30 years, and was the first secretary of the Central Pennsylvania Coal Producers' Association. During the war he was production manager for the Central Pennsylvania district for the United States Fuel Administration. Following the strike of 1919 he acted in an advisory capacity to Rembrandt Peale, then a member of the United States Coal Commission.

V. N. Hacker Again Heads Southern Appalachian Coal Operators'

At the eighteenth annual meeting of the Southern Appalachian Coal Operators, Association, V. N. Hacker, president, Pruden Coal & Coke Co., Knoxville, Tenn., was reelected president. This makes a third term for the popular operator. C. M. Moore, president, Moore Coal Co., Knoxville, Tenn., was reelected first vice president, and C. W. Rhodes, vice president, Fork Ridge Coal & Coke Co., Fork Ridge, Tenn., second vice president. R. E. Howe was reelected secretary of the association.

FOUR GOVERNMENT PUBLICATIONS FOR THE MINE OPERATOR AND STAFF

SOMETIMES the United States Bureau of Mines is accused of issuing publications of too technical a nature. To some extent this may be true, but the results of basic research must be published as well as the practical application. However, of late the mine operator and staff should have no complaint on this score, as shown by the good series of mimeographed reports on mining methods and costs in typical coal and metal regions (later to be printed as regular bulletins), also on milling to be started soon, and the four following reports of 1929, now to be reviewed:

(1) COAL-DUST EXPLOSIONS IN MINES, by G. S. Rice. Technical Paper 448, 24 pages, price 5 cents.

(2) METHODS, COSTS, AND SAFETY IN STRIPPING AND MINING COAL, COPPER ORE, IRON ORE, BAUXITE, AND PEBBLE PHOSPHATE, by F. E. Cash and M. W. von Bernewitz. Bulletin 298, 275 pages, price 70 cents.

(3) COAL-WASHING INVESTIGATIONS: METHODS AND TESTS, by H. F. Yancey and Thomas Fraser. Bulletin 300, 259 pages, price 50 cents.

(4) EFFICIENCY, COST, AND SAFETY OF STORAGE-BATTERY EQUIPMENT IN BITUMINOUS COAL MINES, AND SOME COMPARISONS WITH WIRED TRANSMISSION OF POWER. Cooperative Bulletin 42 of the U. S. Bureau of Mines and Carnegie Institute of Technology, 263 pages, price $2.

(1) COAL DUST IN MINES

In its experimental mine near Pittsburgh the Bureau of Mines has conducted more than 1,200 tests on the explosibility of various coal dusts, and including the investigations made by the Technologic Branch of the U. S. Geological Survey prior to 1910, bureau engineers have assisted at and examined hundreds of mines in which explosions and fires had occurred. Therefore, what this bureau publishes regarding the hazard of coal dust, what causes it to explode, its effects, and how the hazard may be minimized or prevented may be regarded as correct.

Coal dust is made underground by cutting, shearing, drilling, blasting, shoveling, falling off or leaking from cars, and dumping; therefore, it permeates and settles in every part of a mine. The quantity of dust made ranges from 0.2 to 1 percent of the coal mined, although this is difficult to estimate precisely.

Broadly, there are two ways of preventing explosions of gas and coal dust: (1) To prevent accumulations of gas by ventilation and to neutralize coal dust by thorough rock dusting, and (2) to eliminate sources of ignition. To this may be added the prevention of accumulations of dust in the workings by systematic cleaning up of roadways and other places. All of these practices have been covered in detail by the Bureau of Mines in other publications, but this Technical Paper 448 is a good reference for all underground and surface employes.

(2) STRIPPING MINERALS

Stripping or open-pit mining in the United States removes about 78,000,000 tons of marketable minerals and 300,000,000 cubic yards of overburden in an average year. These minerals are 150,000 tons of bauxite, 19,000,000 tons of coal, 24,000,000 tons of copper ore, 32,000,000 tons of iron ore, and 2,700,000 tons of pebble phosphate. These operations are under way in 30 states and employ 20,000 men, exclusive of those engaged in the manufacture of shovels and accessories. Strip mining is a comparatively safe occupation. It produces minerals of low market value, and most of them, particularly coal, now being extracted by this method could not be recovered underground because of the shallow overburden and contingent expense and hazard.

Since the first stripping was tried in 1866, the types of machinery and accessories used have been greatly improved, and engineers and mechanics of front rank are engaged in their design and manufacture. A glance at an electric well or churn drill, a plant for making liquid oxygen explosive, a ¾ or 15-yd. electric shovel, an electric or gasoline locomotive, and cars of 4 to 80 ton capacity proves the foregoing assertion.

The price of stripping land; prospecting it and laying out a strip pit; drilling, blasting, and removing the overburden and mineral beneath; the equipment and men employed; the quantities handled; the cost of operations; and the accident and financial risks connected with open-pit mining are all discussed in detail in this what may be termed a manual of strip mining.

(3) WASHING COAL

Most industrial and many domestic consumers demand a clean bituminous coal; that is, one as low in ash and sulfur as economically feasible to produce. Consequently the cleaning of coal by wet and dry methods is assuming considerable importance, and the total quantity of cleaned coal approximates 30,000,000 tons a year. In the Pittsburgh district particularly several large washeries have recently started operation and the future tonnage will be large. For many years the Bureau of Mines has carried on joint investigations on the washing of coals from almost every state and has published many papers thereon. This last report describes the washability studies of many types of coals, varying from the easily washed types to the extremely refractory types. Tests were conducted with many of the coal-cleaning machines and processes now employed. On some coals the work was confined to an estimation of washing characteristics by the float-and-sink method. Attention was devoted to some phases of the dewatering problem, particularly the use of vacuum filters for coal sludge. The economics of washed coal are discussed, so are the effect of impurities and their physical forms and chemical natures. Seven groups of coals from various parts of 12 states were given washability examinations; therefore, this bulletin should be a complete guide on what to look for, do, and expect in any other tests that may be made.

(4) ELECTRIC POWER UNDERGROUND

A two year's study in seven large bituminous coal mines in two states of the relative merits of wired and wireless power for underground operations, mainly haulage, should give some practical findings, and it does. The tests, made on equipment in regular operation and handling large quantities of coal, included the use of various types of cutting and shearing machines supplied with power from storage-battery power tanks and trolley wires and trailing cables; gathering and main-line haulage by cable-reel, storage-battery, and trolley locomotives and power tanks; and power for loading machines, portable pumps, rock-dusting machines, air compressors, and coal drills from trolley wires and power tanks. These tests included a consideration of power source, consumption, and efficiency; travel; time studies; time delays; effect of low voltage; converter units; rail bonds; charging batteries; charging panels; battery characteristics; costs, and safety. The broad conclusion reached was that, under similar conditions of work, storage-battery equipment is preferable to other forms of power supply in efficiency, cost, and safety, particularly the third item. Such equipment facilitates certain operations and is reliable and economical.

WITH THE MANUFACTURERS

Detachable Watthour Meter

Detachable Watthour meters for use either indoor or outdoor are now available. Westinghouse Electric and Manufacturing Company has designed and put them on the market. The meter consists of the standard temperature-compensated OB watthour meter housed in a weather-proof case. Among its advantages are:

Plug terminals which make installation or removal easy; detachable meters can be plugged into place or removed in a moment like radio tubes.

Suitable for mounting in any location, outdoor or indoor.

Reduces labor, reading, and testing costs.

Completely iron-clad and tamper-proof.

Adjustable terminal block which permits mounting the meter with conduit entrance at top, bottom right or left.

Particularly adaptable to modern methods of conduit wiring employed in apartment buildings.

Edison Fellowship Established by General Electric Co.

In honor of Thomas A. Edison and in commemoration of the fiftieth anniversary of his incandescent lamp, an Edison fellowship for research in the General Electric research laboratory at Schenectady, N. Y., has been established. Its object is to help determine the fitness of the fellow for industrial or scientific research by arranging for a year's research in that laboratory. The opportunity will be given to the selected candidate who has adequate training, and who has done sufficient original work, to have indicated an aptitude for research. The year's fellowship carries a grant of $3,000.

The selection from applicants will be made by the National Research Council, with the advice of the director of research of the General Electric Company. The committee includes: Dr. George K. Burgess, director of the U. S. Bureau of Standards and chairman of the National Research Council, chairman of the committee; Dayton C. Miller, professor of physics of the Case School of Applied Science and chairman of the division of physical sciences of the National Research Council; James E. Mills, chief of the research division of Englewood Arsenal and chairman of the division of chemistry of the National Research Council; and A. E. Kennelly, professor of electrical engineering at Harvard University. Dr. Willis R. Whitney, vice president and director of the research laboratory of the General Electric Company, represents that company.

The choice of research work will be influenced by the preference of the individual, and may be the continuation of studies already begun at college if suitable laboratory facilities are available, or the fellow may work on new or specially selected projects, either independently or in cooperation with others.

M. S. A. Takes Part in Pittsburgh's Light Celebration

Five hundred thousand people are estimated to have lined the route of march to witness a gigantic parade of illuminated floats held in Pittsburgh, Wednesday night, October 23, as a fitting climax to the celebration of Light's Golden Jubilee in honor of Thomas A. Edison and his invention of the incandescent lamp. In addition to honoring Mr. Edison, the memory of four of Pittsburgh's sons were likewise honored; namely, Andrew Carnegie, H. C. Frick, H. J. Heinz, and George W. Westinghouse.

Conspicuous among these floats was that of the Mine Safety Appliances Company which depicted the use of the Edison Electric Safety Mine Lamp. The M-S-A float was built so as to represent a mine entrance and just outside the entrance was a pit wagon filled with coal surrounded by four miners wearing the Edison Safety Cap Lamp, his great contribution to mine safety. For many years, the Mine Safety Appliances Company have been the exclusive distributors of these lamps for Mr. Edison.

An unusual bit of romance is attached to the development of the Edison Lamp. Back in 1911, when Mr. Edison's Nickel-Iron Alkaline Storage Battery had passed the development stage and was being successfully used for many applications, certain executives of the Philadelphia and Reading Coal and Iron Company interviewed Mr. Edison and told him of their intense interest in electric lamps for underground workmen in order to provide better illumination and safety against the ignition of gas. This humanitarian appeal interested Mr. Edison greatly and although he was very deeply absorbed in other lines of research work, he found time, nevertheless, to devote to the development of the miners' lamp and made up a number of lamps operated by miniature storage batteries which were subsequently approved by the United States Bureau of Mines. Mr. Edison did not realize at the time that the lamp had any commercial value but since this great invention, the Mine Safety Appliances Company have distributed more than 350,000 Edison Cap Lamps in the United States and Canada.

Mr. Edison's sole interest in this development was actuated not for commercial reasons but purely by the humanitarian arguments presented to him by the officials of the Philadelphia and Reading Coal and Iron Company.

Mine Safety Appliances' Float — Pittsburgh's Celebration of Lights Golden Jubilee.

Allis-Chalmers Appoints Pennsylvania Representatives

Allis-Chalmers Mfg. Company, Milwaukee, Wis., announces the appointment of the T. B. Wood's Sons Company, Chambersburg, Pa., as special distributors for Texrope Drives. They will carry a large stock of Texrope Drives as well as Texrope belts at Chambersburg, Pa., and will be in a position to make proper recommendations and to render prompt and efficient service in connection with Texrope Drives.

Westinghouse Engineer Receives Honorary Degree

In recognition of his outstanding work in the field of electrical transmission engineering, Queens University recently conferred the honorary degree of Doctor of Laws on Charles Le Geyt Fortescue, chief consulting transmission engineer for the Westinghouse Electric and Manufacturing Company, who is known as a world authority in his field.

Hercules Powder Co. Announces Change and Addition in Personnel

J. J. Kelleher has become associated with the contractor's division, Explosives Department of the Hercules Powder Company. Mr. Kelleher, well-known throughout the southeast as an experienced explosives man, leaves Tampa, Fla., to make Wilmington, Del., Hercules' home office, his headquarters.

J. R. St. Clair, formerly of the sales force of the Hercules Powder Company's branch office in Duluth, Minn., is now in Wilmington, Del., with the Hercules explosives technical service staff. Mr. St. Clair, who has had wide experience in mines and quarries of the Duluth district, will hereafter be connected with the home office.

E. D. Spicer Assistant Manager of General Electric, Schenectady Works

E. D. Spicer, superintendent of the refrigeration department of the General Electric Company, has been made assistant manager of the Schenectady works, effective August 1, according to an announcement made by C. C. Chesney, vice president of manufacturing.

The Ohio Malleable Iron Company Elects New Officers

The Ohio Malleable Iron Company, Columbus, Ohio, a subsidiary of the Jeffrey Manufacturing Company, announces the election of Mr. W. A. Grieves as secretary and Mr. H. Supp, Jr., as treasurer. Both men have similar positions with the Jeffrey Manufacturing Co.

Mr. J. F. Davidson has been elected to the board of directors of the Ohio Malleable Iron Company.

New Headlight Resistance Gives Higher Efficiency

A new headlight resistance for electric railway and mining service, embodying two principle refinements—increased efficiency of the individual units and greater ease of maintenance—has been recently placed on the market by the Ohio Brass Company. The new resistance possesses all of the good features of the old model in addition to several late improvements.

The units of the O-B resistance are of the exposed wire type which operate at a comparatively low temperature, in contrast to the covered wire type which greatly reduces radiation and results in a much higher operating temperature. The wire being of a nickle-chromium composition, it completely eliminates all rust, corrosion, or brittleness brought about through long use.

The tubes which support the wires are threaded in order to remove all possibility of the individual turns coming into contact and shorting a part of the coil. These tubes are arranged side by side so that the heat given off from one can not strike another. Ventilation is afforded by two baffles, mounted on top of the resistance, forming a duct for air circulation. These baffles also serve to prevent the heat of the tubes from rising to the surface on which they are mounted.

In order to exactly meet the requirements of individual users, and to make up for possible variations in line voltage, a sliding shunt is attached to two adjacent tubes. In this way the proper amount of current, which is essential to good operation, is always delivered to the lamp.

There are no exposed operating parts in the new resistance. The cover may be readily removed without danger of losing the holding ratchets which are securely fastened to the base. If after long service, it finally becomes necessary to replace a tube, it can be accomplished very quickly without disturbing any of the others. In place of the pig tails which were formerly used as connections, the new units are joined with brass strips which can never become loosened and which have completely overcome sagging and the resultant danger of grounded contacts.

There are knock-out plates to accomodate conduit, and by conforming to certain requirements, it is possible to obtain the Board of Fire Underwriters' approval on the installation.

The new O-B Form D Removable Unit Resistance may be had for all voltages and has proven itself to be highly efficient in operation.

Vulcan Receives Order for Briquette Machinery

Vulcan Iron Works, of Wilkes-Barre, Pa., has received a large order from Winding Gulf Collieries Co., Bluefield, W. Va., for bituminous briquette machinery, which, with the volume of unfilled orders on hand and several prospective contracts, is expected to keep all branches of the company operating steadily throughout the winter.

Delivery, according to terms of the agreement, would be made before January 1.

Crushers, conveyors, presses, driers, elevators and steam boilers are included in the contract. When the various pieces are completed, they will be shipped to Bluefield, W. Va., and will be assembled under direction of supervisors from the Vulcan plant.

The machinery will be used by the purchaser to utilize a large volume of slack which accumulates from mining and which the company has been unable to sell heretofore because of a suitable binder. The company, after a series of experiments, believes it has solved this problem and will attempt to enter the briquette field on a large scale. Virtually all of the company's markets are in Southern Ohio and in Illinois.

Plant Addition Strengths Sullivan Production

Sullivan Machinery Company, Chicago, reports a gratifying increase in the demand for its products during the current year, including air compressors, mining and quarrying machinery, core drills, portable air compressors, concrete breakers, rock drills, portable hoists, etc.

To meet this growing demand the company has recently completed the construction of an addition to its Michigan City, Ind., plant.

Machine tool equipment at both the Claremont, N. H., and Michigan City, Ind., plants has been increased during the year, and orders are already placed for additional tools, which will secure a large volume of production.

New Book Describes Rotary Rail road Car Dumpers

Link-Belt Company, of Chicago, has issued a new book describing the Link-Belt Rotary Railroad Car Dumper. The book illustrates the dumper in various positions, and a double page spread points out the main features of its mechanism.

Various types of car dumpers have been used successfully for many years in power plants and on the principal loading docks, both on the great Lakes and the Atlantic Seaboard, where the rapid loading of vessels is of paramount importance. The handling of a large volume of material continuously was formerly necessary, in order to effect economies. Now, with the development of the rotary railroad car dumper described in this book, No. 1004, the economies of the lifting type of dumper have been brought within the reach of those whose unloading requirements are small. The book will be sent, upon request, to any one interested.

Hercules Men Receive New Appointments

An addition to the personnel of the explosives department is announced by Hercules Powder Company with the appointment of R. B. McKinney as assistant to the general manager of that department. Mr. McKinney has been a member of the Hercules organization for 17 years, having been director of purchases since 1918. He is a well-known figure in the explosives industry and has a wide acquaintance in the industrial field.

He will be succeeded as head of the purchasing department by F. P. H. Sholly, now assistant director of purchases. Mr. Sholly has been in the explosives business for 13 years and was formerly assistant general manager of the Aetna Explosives Company when that company was acquired by the Hercules Powder Company in 1921. He was previously identified with the iron and steel industry.

An article on "Operating Experience Proves Pulverized Lignite a Satisfactory Fuel" is a summary of the experience of the San Antonio Public Service Company in burning Texas lignite in pulverized form during the past three years at its Comal Plant, New Braunfels, Tex., and has been distributed by the Combustion Engineering Corporation.

This interesting article proves that the large lignite deposits in Texas are adapted to the pulverized fuel method of combustion, and represent a cheap and satisfactory fuel for power plants.

Oxwelded Piping

A 24-page booklet containing helpful and instructive information on the installation of oxy-acetylene welded piping for industrial uses and also for the heating of domestic and industrial buildings.

The first section considers the uses of oxwelded piping in industrial plants including piping for the transportation of oil, gas, chemicals, water, etc., and the second section deals mainly with piping for heating and heating systems. The widespread and ever increasing use of the oxy-acetylene process for welding piping should make this booklet in very great demand. Copies of this are available from The Linde Air Products Company, 30 East 42nd Street, New York, N. Y., or from any of their 26 district sales offices which are located in the principal cities of the country.

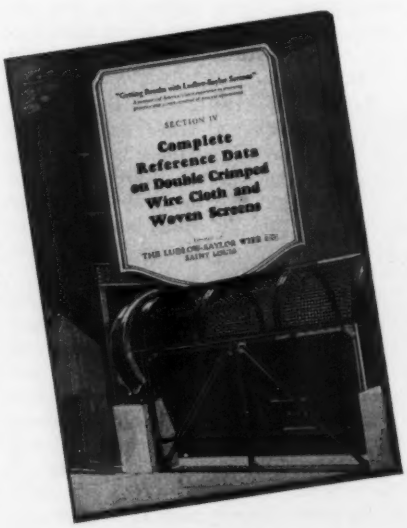
Ludlow-Saylor Issues New Reference Book

The Ludlow-Saylor Wire Co., of St. Louis, have issued a 36-page booklet giving complete reference data on Double Crimped Wire Cloth and Woven Wire Screens. Illustrations show numerous well-known filter-presses, revolving screens, sifters, vibrating screens, driers, strainers, pulverizers, grinding mills, etc., whose operation and output are controlled with wire cloth and woven wire screens.

Hundreds of wire cloth meshes are listed and illustrated, including many unusual ones. Among the latter are screens of 2¼, 2¾, 3¼, and 3¾ meshes per inch; 5½, 6½, 7½, 8½, and 9½ meshes per inch; 11, 13, and 15 meshes per inch.

Numerous extra-heavy square meshes are also listed, such as 50-mesh of No. 33 wire, wherein the .0118-in. wires are woven up to leave clear openings only .0082 in. wide. There are 50 or more of these extra-heavy screens wherein the wire diameter is actually larger than the nominal opening between wires.

Copies of this booklet will be sent upon request.



Ohio Brass Boston Office Moves

The Ohio Brass Company, Mansfield, Ohio, announces that its Boston office, in charge of Harvey H. Hoxie, has been removed from its former location in the Little Building, to Room 1001, Statler Building, 20 Providence Street. The telephone number, Hancock 7153, remains the same.

New Catalog Describes Chain Grate Stoker

A new catalog which describes and illustrates the Green Natural Draft Chain Grate Stoker has been issued by Combustion Engineering Corporation, New York, N. Y.

This stoker is one of the pioneer stokers of its type and is applicable to boilers of all types where the load and operating conditions are such that a natural draft chain grate stoker is suitable. The Stokers burn the screenings from all grades of non-coking or moderately coking bituminous coals, high-ash coals and many lignites.

Among the interesting features of the catalog are the table which shows three typical evaporative tests, and drawings showing applications of this stoker to various types of boilers.

American Cable Company's Chicago Office Moves to New Quarters

The Chicago headquarters of the American Cable Company, handling sales and service on Tru-Lay wire rope and Tru-Loc fittings in the Chicago region, have been moved to the recently completed Chicago Daily News Building. The former address was 160 North La Salle Street; the new is Room 1765, 400 West Madison Street, Chicago, Ill.

Erie City Iron Works, Erie, Pa., have recently issued two booklets, one of 16 pages covering their Erie City three-drum boiler and one of 12 pages describing and illustrating their "Economic" boiler. A feature of the latter booklet is a large phantom view with principal points of construction pointed out by arrows.

A new bulletin No. 801, describing hard-boiled hats and caps, has been published by Bullard-Davis, Inc., New York City, manufacturers of first aid and safety service equipment. The average weight of the hard-boiled hat is 10 ounces. It is waterproof, fireproof, and non-conductive of electricity.

BUYER'S DIRECTORY

ACETYLENE, Dissolved (Or in Cylinders)
Prest-O-Lite Co., Inc.

ACETYLENE GAS
Prest-O-Lite Co., Inc.

ACETYLENE GENERATING APPARATUS
Oxweld Acetylene Co.

ACID, SULPHURIC
Irvington Smelt. & Ref. Works.

AERIAL TRAMWAYS
American Steel & Wire Co.

AFTERCOOLERS (Air)
Ingersoll-Rand Co.

AIR COMPRESSORS
Allis-Chalmers Mfg. Co.
Sullivan Machinery Co.
Ingersoll-Rand Co.

AIR COMPRESSOR OILS
Standard Oil Co. (Ind.)

AIR FILTERS—Bag type
American Coal Cleaning Corpn.

AIR HEATERS
Westinghouse Electric & Mfg. Co.

AIR LIFT PUMPING
Sullivan Machinery Co.

ALL SERVICE GAS MASKS
Mine Safety Appliances Co.

ANEMOMETERS
Mine Safety Appliances Co.

ANNUNCIATOR WIRES & CABLES
Roebling's Sons Co., J. A.

ANNUNCIATOR WIRES & CABLES, INSULATED
American Steel & Wire Co.

ANTI-RUST OILS & GREASES
Standard Oil Co. (Ind.)

ARMATURE COILS & LEADS
General Electric Co.
Roebling's Sons Co., J. A.
Westinghouse Electric & Mfg. Co.

ARMORGRIDS
General Electric Co.

ASPIRATORS
American Coal Cleaning Corpn.

AUTOMATIC CAR & CAGER STOPS
Link-Belt Co.
Mining Safety Device Co.

AUTOMATIC CAR CAGES
Connellsville Mfg. & Mine Supply Co.
Link-Belt Co.
Roberts & Schaefer Co.

AUTOMATIC CAR DUMPERS
Link-Belt Co.
Roberts & Schaefer Co.

AUTOMATIC FLAGGING SIGNALS
American Mine Door Co.

AUTOMATIC (Mine Doors, Trucks and Electric Switches)
American Mine Door Co.

AUTOMATIC MINE SWITCHES
Westinghouse Electric & Mfg. Co.

AUTOMATIC SWITCH THROWERS
American Mine Door Co.
Westinghouse Electric & Mfg. Co.

AUTOMOBILE CABLES
Roebling's Sons Co., J. A.

AUTOMOTIVE LUBRICANTS
Keystone Lubricating Co.

BAG TYPE AIR FILTERS
American Coal Cleaning Corpn.

BALLAST UNLOADER ROPES
Roebling's Sons Co., J. A.

BARS, STEEL
Carnegie Steel Co.
Timken Roller Bearing Co.

BATTERIES
E. I. du Pont de Nemours & Co.

BATTERIES, Armature
Westinghouse Electric & Mfg. Co.

BATTERIES, Blasting
Hercules Powder Co.

BATTERIES, DRY (for Bells, Buzzers, Signals, Blasting)
National Carbon Co., Inc.

BATTERIES (Storage, Gas Welding, Cutting, Dissolved Acetylene)
Prest-O-Lite Co.
Westinghouse Electric & Mfg. Co.

BATTERY CHANGING STATION
Atlas Car & Mfg. Co.

BEARINGS (for all kinds of equipment)
Hyatt Roller Bearing Co.

BEARINGS, RADIAL
Timken Roller Bearing Co.

BEARINGS, TAPERED ROLLER
Timken Roller Bearing Co.

BEARINGS, THRUST
Timken Roller Bearing Co.

BELL CORD
Roebling's Sons Co., J. A.

BELT DRESSING
Standard Oil Co. (Ind.)

BELTING (Conveyor, Elevator, Transmission)
The Jeffrey Mfg. Co.
Link-Belt Co.

BELTING, SILENT CHAIN
Link-Belt Co.
Morse Chain Co.

BINS (Coke and Coal)
The Jeffrey Mfg. Co.
Link-Belt Co.

BIT BOXES
Mine Safety Appliances Co.

BITS, Carbon (Diamonds) for Core Drill
R. S. Patrick.
Diamond Drill Carbon Co.

BITS, Diamond Drilling
R. S. Patrick.

BIT SHARPENERS
Sullivan Machinery Co.
Ingersoll-Rand Co.

BLACK DIAMONDS
Diamond Drill Carbon Co.
R. S. Patrick.

BLACK OILS
Standard Oil Co. (Ind.)

BLASTING ACCESSORIES
E. I. du Pont de Nemours & Co.

BLASTING CAPS
E. I. du Pont de Nemours & Co.
Hercules Powder Co.

BLASTING MACHINES
E. I. du Pont de Nemours & Co.
Hercules Powder Co.

BLASTING POWDER
E. I. du Pont de Nemours & Co.
Hercules Powder Co.

BLASTING SUPPLIES
Hercules Powder Co.

BLASTING UNITS (Dry Battery)
National Carbon Co., Inc.

BLOWERS, CENTRIFUGAL
American Coal Cleaning Corpn.
General Electric Co.
Ingersoll-Rand Co.
The Jeffrey Mfg. Co.
Robinson Ventilating Co.
Westinghouse Electric & Mfg. Co.

BLOWERS (or Compressors)
General Electric Co.

BLOWERS (Tubing)
The Jeffrey Mfg. Co.
Robinson Ventilating Co.

BLOWERS (Turbine)
Robinson Ventilating Co.
Westinghouse Electric & Mfg. Co.

BLOWPIPES, Brazing, Carbon Burning, Cutting, Lead Burning Welding, Welding and Cutting
Oxweld Acetylene Co.

BLUE CENTER STEEL WIRE ROPE
Roebling's Sons Co., J. A.

BOND TERMINALS
American Mine Door Co.

BORTZ
R. S. Patrick.
Diamond Drill Carbon Co.

BRACES, GAUGE
Central Frog & Switch Co.

BRACES, RAIL
Central Frog & Switch Co.

BRACES, TRACK
Central Frog & Switch Co.

BRAZILIAN ROCK CRYSTAL
Diamond Drill Carbon Co.

BREAKER MACHINERY
Koppers-Rheolaveur Co.
Vulcan Iron Works.

BREAKERS
American Coal Cleaning Corpn.

BREAKERS (Construction and Machinery)
The Jeffrey Mfg. Co.

BREAST MACHINES
Goodman Mfg. Co.

BRIQUETTING MACHINERY
Vulcan Iron Works.

BRUSHES (Carbon, Graphite and Metal Graphite for Electric Motors, Generators and Converters)
National Carbon Co., Inc.
Westinghouse Electric & Mfg. Co.

BUCKETS (Elevator)
Atlas Car & Mfg. Co.
The Jeffrey Mfg. Co.
Link-Belt Co.

BURRELL, GAS INDICATORS, GAS MASKS, MINE AIR ANALYZER
Mine Safety Appliances Co.

CABLE COMPOUNDS
Standard Oil Co. (Ind.)

CABLE—DRILLING, WIRE
American Cable Co.

CABLE—ELEVATOR, MACHINE, ETC. (STEEL)
American Cable Co.

CABLE GREASE
Keystone Lubricating Co.

CABLE—HOISTING
American Cable Co.

CABLE — MINING (HAULAGE, SHAFT HOIST, MINING MACHINE, SLUSHER)
American Cable Co.

CABLES
American Steel & Wire Co.
Roebling's Sons Co., J. A.

CABLES (Connectors and Guides)
American Mine Door Co.

CABLES, INSULATED
General Electric Co.
Roebling's Sons Co., J. A.

CABLES, SUSPENSION BRIDGE
American Cable Co.
Roebling's Sons Co., J. A.

CABLEWAYS
American Steel & Wire Co.
The Jeffrey Mfg. Co.
Link-Belt Co.

CABLE—WIRE
American Cable Co.

CAGE DUMPERS, ROTARY
Link-Belt Co.
Roberts & Schaefer Co.

CAGES (Safety Appliances)
Connellsville Mfg. & Mine Supply Co.

CAGE STOPS & LOCKS
Link-Belt Co.
Mining Safety Device Co.
Roberts & Schaefer Co.

CAGERS, AUTOMATIC
Link-Belt Co.
Mining Safety Device Co.
Phillips Mine & Mill Supply Co.
Roberts & Schaefer Co.

CAGERS, AUTOMATIC & MANUAL
Link-Belt Co.
Mining Safety Device Co.
Roberts & Schaefer Co.

CAGES
Allis-Chalmers Mfg. Co.
C. S. Card Iron Works Co.
Connellsville Mfg. & Mine Sup. Co.
Link-Belt Co.
United Iron Works, Inc.
Vulcan Iron Works.

CAGES (Self-dumping)
Link-Belt Co.
Roberts & Schaefer Co.
Vulcan Iron Works.

CALCINERS
Vulcan Iron Works.

CALCIUM CARBIDE
Union Carbide Sales Co.

CARBON AND BORTZ
Diamond Drill Carbon Co.
R. S. Patrick.

CARBON FOR DIAMOND DRILLING
Diamond Drill Carbon Co.
R. S. Patrick.
Sullivan Machinery Co.

CARBON BURNING APPARATUS
Oxweld Acetylene Co.

CARBON ELECTRODES (for Electric Furnaces and Electrolytic Work)
National Carbon Co., Inc.
Westinghouse Electric & Mfg. Co.

CARBON MONOXIDE DETECTOR
Mine Safety Appliances Co.

CARBONS (for Arc Lamps, Blue Printing, Photographic)
National Carbon Co., Inc.

CARBON RODS AND PASTE FOR WELDING
Oxweld Acetylene Co.
National Carbon Co., Inc.

CARBON SPECIALTIES (Circuit Breaker Contacts, Packing Rings, Filter Plates, Tubes, etc.)
National Carbon Co., Inc.

CAR DUMPERS, GRAVITY & POWER
Link-Belt Co.
Mining Safety Device Co.
Phillips Mine & Mill Supply Co.
Roberts & Schaefer Co.

CAR DUMPERS (Rotary)
Connellsville Mfg. & Mine Supply Co.
Link-Belt Co.
Mining Safety Device Co.
Phillips Mine & Mill Supply Co.
Roberts & Schaefer Co.

CAR FEEDERS
Link-Belt Co.
Mining Safety Device Co.
Roberts & Schaefer Co.

CAR HAULS
Goodman Mfg. Co.
Hockensmith Wheel & Mine Car Co.
The Jeffrey Mfg. Co.
Link-Belt Co.
Roberts & Schaefer Co.

CAR PULLERS
Allis-Chalmers Mfg. Co.
Link-Belt Co.
Roberts & Schaefer Co.

CAR REPLACERS
Johnson Wrecking Frog Co.

CAR RERAILERS
Johnson Wrecking Frog Co.

CAR RETARDERS
Link-Belt Co.
Mining Safety Device Co.
Roberts & Schaefer Co.

CARS OF ALL DESCRIPTION
Hockensmith Wheel & Mine Car Co.

CAR STOPS, AUTOMATIC & MANUAL
Link-Belt Co.
Phillips Mine & Mill Supply Co.
Roberts & Schaefer Co.

CAR WHEEL LUBRICANTS
Keystone Lubricating Co.

CAR WIRE & CABLES
American Steel & Wire Co.
John A. Roebling's Sons Co.

CASTINGS
Goodman Mfg. Co.
Link-Belt Co.
The Jeffrey Mfg. Co.
Timken Roller Bearing Co.

CASTINGS, GRAY IRON
Link-Belt Co.
Vulcan Iron Works.

CASTINGS, OPEN HEARTH, STEEL
Vulcan Iron Works.

CASTINGS (Steel, Iron)
Vulcan Iron Works.

CAST STEEL FROGS
Central Frog & Switch Co.

CHAINS
Goodman Mfg. Co.
The Jeffrey Mfg. Co.
Link-Belt Co.
Morse Chain Co.

CHAINS, AUTOMOBILE ENGINE
Link-Belt Co.
Morse Chain Co.

CHAINS, COAL CUTTING
Goodman Mfg. Co.
The Jeffrey Mfg. Co.

CHAINS, DRIVE
Goodman Mfg. Co.
The Jeffrey Mfg. Co.
Link-Belt Co.
Morse Chain Co.

CHAINS, FRONT END
Link-Belt Co.
Morse Chain Co.

CHAIN LUBRICANTS
Standard Oil Co. (Ind.)

CHAINS, OILING
Morse Chain Co.

CHAINS, POWER TRANSMISSION
The Jeffrey Mfg. Co.
Link-Belt Co.
Morse Chain Co.

CHAINS, Silent (Bushed-Pin Joint)
Link-Belt Co.

CHAINS, SILENT (Rocker-Joint)
Morse Chain Co.

CHAINS, SLING
Link-Belt Co.
Morse Chain Co.

CHAINS, SPROCKET WHEEL
Goodman Mfg. Co.
The Jeffrey Mfg. Co.
Link-Belt Co.
Morse Chain Co.

CIRCUIT-BREAKERS
Westinghouse Electric & Mfg. Co.

CLAMPS, GUARD RAIL
Central Frog & Switch Co.

CLAMPS (Mine)
Westinghouse Electric & Mfg. Co.

CLAMPS (Trolley)
General Electric Co.
Ohio Brass Co.
Westinghouse Electric & Mfg. Co.

CLAMPS, WIRE ROPE
American Steel & Wire Co.
Roebling's Sons Co., J. A.

CLIPS, WIRE ROPE
American Cable Co.
American Steel & Wire Co.
Roebling's Sons Co., J. A.

CLOTH, WIRE
Ludlow Saylor Wire Co.

CLUTCHES
Connellsville Mfg. & Mine Supply Co.
Goodman Mfg. Co.
The Jeffrey Mfg. Co.
Link-Belt Co.

COAL CLEANING MACHINERY
American Coal Cleaning Corpn.
Koppers-Rheolaveur Co.
The Jeffrey Mfg. Co.
Link-Belt Co.
Roberts & Schaefer Co.

COAL COMPANIES
Lehigh Coal & Navigation Co.

COAL CONVEYING MACHINERY
American Coal Cleaning Corpn.
Conveyor Sales Co.
Link-Belt Co.

COAL CRUSHERS
Connellsville Mfg. & Mine Supply Co.
The Jeffrey Mfg. Co.
Link-Belt Co.

COAL CRUSHERS & ROLLS
The Jeffrey Mfg. Co.
Link-Belt Co.
Vulcan Iron Works.

COAL CUTTERS
Goodman Mfg. Co.
Ingersoll-Rand Co.
The Jeffrey Mfg. Co.
Sullivan Machinery Co.

COAL HANDLING MACHINERY
American Coal Cleaning Corpn.
Conveyor Sales Co.
Goodman Mfg. Co.
The Jeffrey Mfg. Co.
Joy Manufacturing Co.
Link-Belt Co.
Mining Safety Device Co.
Roberts & Schaefer Co.
Westinghouse Electric & Mfg. Co.

COAL LOADERS
Conveyor Sales Co.
Goodman Mfg. Co.
The Jeffrey Mfg. Co.
Joy Manufacturing Co.
Link-Belt Co.
Sullivan Machinery Co.

COAL MINING MACHINERY
Goodman Mfg. Co.
Ingersoll-Rand Co.
The Jeffrey Mfg. Co.
Link-Belt Co.
Sullivan Machinery Co.
Westinghouse Electric & Mfg. Co.

COAL MINING PLANTS
American Coal Cleaning Corpn.
Goodman Mfg. Co.
Ingersoll-Rand Co.
The Jeffrey Mfg. Co.
Link-Belt Co.
Roberts & Schaefer Co.

COAL PREPARATION MACHINERY
American Coal Cleaning Corpn.
Link-Belt Co.
Roberts & Schaefer Co.

COAL SEPARATING MACHINERY
W. S. Tyler Co.

COAL SEPARATORS (Pneumatic)
American Coal Cleaning Corpn.
Roberts & Schaefer Co.

COAL SEPARATORS (Spiralizers)
Link-Belt Co.

COAL TESTING EQUIPMENT
W. S. Tyler Co.

COMPRESSORS, AIR
Allis-Chalmers Mfg. Co.
Ingersoll-Rand Co.
Sullivan Machinery Co.

COMPRESSORS, MINE CAR
Ingersoll-Rand Co.
Sullivan Machinery Co.

CONCENTRATORS (Table)
Allis-Chalmers Mfg. Co.

CONCRETE REINFORCEMENT
American Steel & Wire Co.

CONDENSERS
Allis-Chalmers Mfg. Co.
Ingersoll-Rand Co.
Westinghouse Electric & Mfg. Co.

CONTROLLERS
General Electric Co.
Goodman Mfg. Co.
The Jeffrey Mfg. Co.
Westinghouse Electric & Mfg. Co.

CONVERTERS, COPPER
Allis-Chalmers Mfg. Co.
Westinghouse Electric & Mfg. Co.

CONVEYORS
American Coal Cleaning Corpn.
Conveyor Sales Co.
The Jeffrey Mfg. Co.
Link-Belt Co.
Roberts & Schaefer Co.
United Iron Works, Inc.

CONVEYOR BEARINGS
Link-Belt Co.

CONVEYORS, BELT
American Coal Cleaning Corpn.
The Jeffrey Mfg. Co.
Link-Belt Co.

CONVEYORS, CHAIN FLIGHT
American Coal Cleaning Corpn.
The Jeffrey Mfg. Co.
Link-Belt Co.

CONVEYORS, COAL
American Coal Cleaning Corpn.
Conveyor Sales Co.
The Jeffrey Mfg. Co.
Link-Belt Co.
Vulcan Iron Works.

CONVEYORS AND ELEVATORS
Allis-Chalmers Mfg. Co.
American Coal Cleaning Corpn.
The Jeffrey Mfg. Co.
Link-Belt Co.

CONVEYORS, PAN OR APRON
American Coal Cleaning Corpn.
The Jeffrey Mfg. Co.
Link-Belt Co.

CONVEYORS, SCREW
American Coal Cleaning Corpn.
The Jeffrey Mfg. Co.
Link-Belt Co.

COOLERS (Man)
Robinson Ventilating Co.

COOLERS, ROTARY
Vulcan Iron Works.

COPPER WIRE & STRAND (Bare)
American Steel & Wire Co.
Roebling's Sons Co., J. A.

CORDS—SASH, STEEL WIRE
American Cable Co.

CORE DRILLS, Carbon (Diamonds) for
R. S. Patrick.

CORE DRILLING
Hoffman Bros. Drilling Co.
Pennsylvania Drilling Co.

COUPLINGS, FLEXIBLE
Link-Belt Co.
Westinghouse Electric & Mfg. Co.

CREOSOTE TREATED TIES, TIMBERS, POSTS, PILING, Etc.
Ayer & Lord Tie Co.

CROSSINGS AND CROSSOVERS
C. S. Card Iron Works Co.
Central Frog & Switch Co.
West Virginia Rail Co.

CROSSOVERS
Central Frog & Switch Co.

CROSS TIES, CREOSOTE TREATED
Ayer & Lord Tie Co.

CRUSHER OILS
Standard Oil Co. (Ind.)

CRUSHERS
Allis-Chalmers Mfg. Co.
The Jeffrey Mfg. Co.
United Iron Works, Inc.

CRUSHERS (Coal)
Connellsville Mfg. & Mine Supply Co.
The Jeffrey Mfg. Co.
Link-Belt Co.
Vulcan Iron Works.

CRUSHERS, SINGLE and DOUBLE ROLL
Allis-Chalmers Mfg. Co.
The Jeffrey Mfg. Co.
Link-Belt Co.

CRUSHING PLANTS, COKE
The Jeffrey Mfg. Co.
Link-Belt Co.

CRYSTAL (Quartz)
Diamond Drill Carbon Co.

CUP GREASE
Keystone Lubricating Co.
Standard Oil Co. (Ind.)

CUTTING APPARATUS, Oxy-Acetylene, Oxy-Hydrogen
Oxweld Acetylene Co.

CYCLONE DUST COLLECTORS
American Coal Cleaning Corpn.

DECARBONIZING APPARATUS
Oxweld Acetylene Co.

DESIGNERS OF PLANTS
American Coal Cleaning Corpn.
Koppers-Rheolaveur Co.
Link-Belt Co.
Roberts & Schaefer Co.

DETONATORS
E. I. du Pont de Nemours & Co.
Hercules Powder Co.

DIAMOND CORE DRILL CONTRACTING
Hoffman Bros. Drilling Co.
Sullivan Machinery Co.

DIAMOND DRILLING CARBON
Diamond Drill Carbon Co.
R. S. Patrick.

DIAMONDS, BLACK (See Carbon and Bortz)
Diamond Drill Carbon Co.
R. S. Patrick.

DIAMONDS, INDUSTRIAL
Diamond Drill Carbon Co.
R. S. Patrick.

DIAMOND TOOLS
Diamond Drill Carbon Co.

DIESEL ENGINE OILS
Standard Oil Co. (Ind.)

DIGGERS & PICKS (Pneumatic)
Ingersoll-Rand Co.

DOORS, AUTOMATIC MINE
American Mine Door Co.

DRIFTERS, DRILL
Ingersoll-Rand Co.
Sullivan Machinery Co.

DRILLERS' DIAMONDS
Diamond Drill Carbon Co.

DRILLING CONTRACTORS
Pennsylvania Drilling Co.
Sullivan Machinery Co.

DRILLING, DIAMONDS for
Diamond Drill Carbon Co.
R. S. Patrick.

DRILLS, AIR AND STEAM
Ingersoll-Rand Co.

DRILLS (Blast Hole)
Ingersoll-Rand Co.

DRILL BITS, Carbon (Diamonds) for
Diamond Drill Carbon Co.
R. S Patrick.

DRILL, CARBON (Diamonds) for
Diamond Drill Carbon Co.
R. S. Patrick.

DRILL COLUMNS & MOUNTINGS
Ingersoll-Rand Co.
Sullivan Machinery Co.

DRILL LUBRICANTS
Standard Oil Co. (Ind.)

DRILLER'S DIAMONDS
R. S. Patrick.

DRILLS, CORE
Hoffman Bros. Drilling Co.
Ingersoll-Rand Co.

DRILLS, ELECTRIC
General Electric Co.
The Jeffrey Mfg. Co.
Westinghouse Electric & Mfg. Co.

DRILLS, HAMMER
Ingersoll-Rand Co.
Sullivan Machinery Co.

DRILLS (Hand Operated Coal)
Ohio Brass Co.

DRILLS, PNEUMATIC
Ingersoll-Rand Co.

DRILLS, PROSPECTING
Hoffman Bros. Drilling Co.
Ingersoll-Rand Co.

DRILLS, ROCK
General Electric Co.
Ingersoll-Rand Co.
The Jeffrey Mfg. Co.
Sullivan Machinery Co.

DRILL STEEL SHARPENERS
Ingersoll-Rand Co.
Sullivan Machinery Co.

DRIVES, SILENT CHAIN
Link-Belt Co.
Morse Chain Co.

DRUMS (Hoisting, Haulage)
Connellsville Mfg. & Mine Supply Co.
Link-Belt Co.
Vulcan Iron Works.

DRY CLEANING COAL & COKE
American Coal Cleaning Corpn.
Link-Belt Co.
Roberts & Schaefer Co.

DRYERS, ROTARY
Vulcan Iron Works.

DUMP CARS
Atlas Car & Mfg. Co.
Connellsville Mfg. & Mine Supply Co.,

DUMPS
United Iron Works, Inc.

DUMPS (Rotary, Cradle, Crossover & Kickback)
C. S. Card Iron Works Co.
Link-Belt Co.
Mining Safety Device Co.
Phillips Mine & Mill Supply Co.
Roberts & Schaefer Co.

DUST COLLECTING EQUIPMENT
American Coal Cleaning Corpn.

DUST FILTERS
American Coal Cleaning Corpn.

DYNAMITE
E. I. du Pont de Nemours & Co.
Hercules Powder Co.

DYNAMOS
Allis-Chalmers Mfg. Co.
General Electric Co.
Goodman Mfg. Co.
Westinghouse Electric & Mfg. Co.

DYNAMO OILS
Standard Oil Co. (Ind)

ELECTRICAL APPARATUS
Allis-Chalmers Mfg. Co.
General Electric Co.
Ohio Brass Co.
Westinghouse Electric & Mfg. Co.

ELECTRICAL CABLES & WIRES
American Steel & Wire Co.
General Electric Co.
Roebling's Sons Co., J. A.

ELECTRIC BLASTING CAPS
Hercules Powder Co.

ELECTRIC HOISTING MACHINERY
Allis-Chalmers Mfg. Co.

ELECTRIC LOCOMOTIVES
General Electric Co.
Goodman Mfg. Co.
The Jeffrey Mfg. Co.
Westinghouse Electric & Mfg. Co.

ELECTRIC LOCOMOTIVE CABLES
Roebling's Sons Co., J. A.
Westinghouse Electric & Mfg. Co.

ELECTRIC MINE SUPPLIES
General Electric Co.
Ohio Brass Co.
Westinghouse Electric & Mfg. Co.

ELECTRIC WIRES AND CABLES
General Electric Co.
American Steel & Wire Co.

ELECTRICAL SUPPLIES
General Electric Co.
Ohio Brass Co.
Westinghouse Electric & Mfg. Co.

ELECTRICAL WIRES AND CABLES
Roebling's Sons Co., J. A.

ELECTRODES, WELDING
Roebling's Sons Co., J. A.

ELEVATORS
The Jeffrey Mfg. Co.
Link-Belt Co.

ELEVATORS, BUCKET
The Jeffrey Mfg. Co.
Link-Belt Co.

ELEVATOR CABLES & ROPES
Roebling's Sons Co., J. A.

ELEVATOR AND HOIST MOTORS
Westinghouse Electric & Mfg. Co.

ELEVATOR MACHINERY
Atlas Car & Mfg. Co.
The Jeffrey Mfg. Co.
Link-Belt Co.

ENGINE OILS
Standard Oil Co. (Ind.)
ENGINES, GAS AND GASOLINE
Allis-Chalmers Mfg. Co.
Ingersoll-Rand Co.
Westinghouse Electric & Mfg. Co.
ENGINES (Hoisting and Hauling)
Connellsville Mfg. & Mine Supply Co.
Westinghouse Electric & Mfg. Co.
ENGINES, OIL
Allis-Chalmers Mfg. Co.
Ingersoll-Rand Co.
ENGINES, STEAM
Allis-Chalmers Mfg. Co.
Ingersoll-Rand Co.
EXCAVATORS
Link-Belt Co.
EXHAUSTERS
American Coal Cleaning Corpn.
EXPLOSIVES
The E. I. du Pont Powder Co.
Hercules Powder Co.
FAN DRIVES
Link-Belt Co.
Vulcan Iron Works.
Westinghouse Electric & Mfg. Co.
FANS, Man Cooling
Robinson Ventilating Co.
Westinghouse Electric & Mfg. Co.
FANS, Turbine
Robinson Ventilating Co.
Westinghouse Electric & Mfg. Co.
FANS, VENTILATING
Connellsville Mfg. & Mine Supply Co.
The Jeffrey Mfg. Co.
Robinson Ventilating Co.
Vulcan Iron Works.
Westinghouse Electric & Mfg. Co.
FEEDERS
Hockensmith Wheel & Mine Car Co.
FEEDERS (Crossover, Kickback, Rotary and Dump)
Link-Belt Co.
Mining Safety Device Co.
Phillips Mine & Mill Supply Co.
Roberts & Schaefer Co.
FEEDERS (Gravity)
American Coal Cleaning Corpn.
Link-Belt Co.
FEEDERS (Hand Operated)
Link-Belt Co.
Mining Safety Device Co.
Roberts & Schaefer Co.
FEEDERS, ORE
The Jeffrey Mfg. Co.
Link-Belt Co.
FEEDERS (Reciprocating)
Link-Belt Co.
American Coal Cleaning Corpn.
FEEDERS (Semi-automatic)
Link-Belt Co.
Mining Safety Device Co.
Phillips Mine & Mill Supply Co.
FIBRE GREASES
Standard Oil Co. (Ind.)
FILTER CLOTH, WIRE
Ludlow Saylor Wire Co.
FILTERS (Dust)
American Coal Cleaning Corpn.
FIRE AND WEATHER-PROOF WIRE
Roebling's Sons Co., J. A.
FIRST AID SUPPLIES
Mine Safety Appliances Co.
FITTINGS—WIRE ROPE (Tru-Loc Brand Processed)
American Cable Co.
FITTINGS—WIRE ROPE (Thimbles, Clips, Sockets, Hooks, Shackles Turnbuckles)
American Cable Co.
FLASHLIGHTS AND BATTERIES (Mine Safety)
National Carbon Co., Inc.
FLOTATION MACHINES
Allis-Chalmers Mfg. Co.
FLOTATION OILS
Hercules Powder Co.
FLOW METERS
General Electric Co.
FLUX, WELDING
Oxweld Acetylene Co.
FORGINGS
Allis-Chalmers Mfg. Co.
FROGS
Central Frog & Switch Co.
FROGS AND SWITCHES
C. S. Card Iron Works Co.
Central Frog & Switch Co.
West Virginia Rail Co.
FURNACE OIL
Standard Oil Co. (Ind.)
FURNACES, Oil (for drill steel)
Ingersoll-Rand Co.
FURNACES, ROASTING
Allis-Chalmers Mfg. Co.
Westinghouse Electric & Mfg. Co.
GAS (Cutting, Welding)
Prest-O-Lite Co., Inc.
GAS (Nitrogen, Oxygen)
Linde Air Products Co.
GASOLINE
Standard Oil Co. (Ind.)
GAS ENGINE OILS
Standard Oil Co. (Ind.)
GAS MASKS
Mine Safety Appliances Co.
GAUGES, WELDING & CUTTING
Central Frog & Switch Co.
GAUGE RODS
Central Frog & Switch Co.
GAUGES, WELDING & CUTTING
Oxweld Acetylene Co.
GEAR COMPOUNDS
Standard Oil Co. (Ind.)
GEARS
Goodman Mfg. Co.
The Jeffrey Mfg. Co.
Link-Belt Co.
GEARS, BEVEL
Goodman Mfg. Co.
The Jeffrey Mfg. Co.
Link-Belt Co.
GEARS (Fabroil & Textolite)
General Electric Co.
GEARS, HERRINGBONE
Link-Belt Co.
Vulcan Iron Works.
GEARS, Machine Cut
Link-Belt Co.
Vulcan Iron Works.
GEARS, Moulded Tooth
Link-Belt Co.
Vulcan Iron Works.
GEARS, Silent Chain
Link-Belt Co.
Morse Chain Co.
GEARS, SPUR
Goodman Mfg. Co.
The Jeffrey Mfg. Co.
Link-Belt Co.
Vulcan Iron Works.
GEARS, WORM
The Jeffrey Mfg. Co.
GELATIN DYNAMITES
E. I. Du Pont de Nemours & Co.
Hercules Powder Co.
GENERATORS AND GENERATING SETS
Allis-Chalmers Mfg. Co.
General Electric Co.
Goodman Mfg. Co.
Westinghouse Electric & Mfg. Co.
GENERATORS, ACETYLENE
Oxweld Acetylene Co.
GLOVES, ASBESTOS
Oxweld Acetylene Co.
GOGGLES, MINERS' WIRE SCREEN, NOD AND SHAKE WELLSWORTH
Mine Safety Appliances Co.
GOGGLES, WELDING
Oxweld Acetylene Co.
GRAPHITE GREASES
Standard Oil Co. (Ind.)
GREASE
Keystone Lubricating Co.
Standard Oil Co. (Ind.)
GREASE CUPS
Keystone Lubricating Co.
GRINDERS, Portable Pneumatic
Ingersoll-Rand Co.
GUARD RAIL CLAMPS
Central Frog & Switch Co.
GUY ROPES, GALVANIZED
American Steel & Wire Co.
Roebling's Sons Co., J. A.
HAMMERS, Calking, Chipping & Riveting
Ingersoll-Rand Co.
HANGERS
Link-Belt Co.
HANGERS (Insulated Trolley)
Ohio Brass Co.
HANGERS, SHAFT, DROP
Link-Belt Co.
HANGERS, SHAFT, POST
Link-Belt Co.
HANGERS, SHAFT, SELF-OILING
Link-Belt Co.
HAULAGE ROPE
American Steel & Wire Co.
Roebling's Sons Co., J. A.
HEADLIGHTS, ARC AND INCANDESCENT
General Electric Co.
Goodman Mfg. Co.
The Jeffrey Mfg. Co.
Ohio Brass Co.
Westinghouse Electric & Mfg. Co.
HEATER CORD
Roebling's Sons Co., J. A.
HERRINGBONE GEAR DRIVES
Link-Belt Co.
H-H INHALATORS
Mine Safety Appliances Co.
HIGH EXPLOSIVES
E. I. Du Pont de Nemours & Co.
Hercules Powder Co.
HOIST DRIVES
Link-Belt Co.
Vulcan Iron Works.
HOISTING ROPES
American Steel & Wire Co.
Connellsville Mfg. & Mine Supply Co.
Roebling's Sons Co., J. A.
HOISTS
American Steel & Wire Co.
Ingersoll-Rand Co.
Link-Belt Co.
Sullivan Machinery Co.
United Iron Works, Inc.
HOISTS, AIR
Ingersoll-Rand Co.
Sullivan Machinery Co.
HOISTS, ELECTRIC
Allis-Chalmers Mfg. Co.
Connellsville Mfg. & Mine Supply Co.
General Electric Co.
Goodman Mfg. Co.
Sullivan Machinery Co.
Vulcan Iron Works
HOISTS, PORTABLE
Ingersoll-Rand Co.
Sullivan Machinery Co.
HOISTS, Room
Vulcan Iron Works.
HOISTS, Room and Gathering
Goodman Mfg. Co.
HOISTS, Scraper-Loader
Connellsville Mfg. & Mine Supply Co.
Ingersoll-Rand Co.
Sullivan Machinery Co.
HOISTS, STEAM
Allis-Chalmers Mfg. Co.
Connellsville Mfg. & Mine Supply Co.
Ingersoll-Rand Co.
Vulcan Iron Works.
HOLDERS-ON RIVETING
Ingersoll-Rand Co.
HOOKS
Roebling's Sons Co., J. A.
HOOKS, WIRE ROPE
American Cable Co.
HOSE, AIR AND STEAM
Ingersoll-Rand Co.
HOSE, WELDING AND CUTTING
Oxweld Acetylene Co.
HYDRATORS, LIME
Vulcan Iron Works.
IGNITERS, Electric
Hercules Powder Co.
INCINERATORS
Vulcan Iron Works.
INCLINE FROGS
Central Frog & Switch Co.
INCLINE TRACK LAYOUTS
Central Frog & Switch Co.
INSULATORS, FEEDER WIRE
General Electric Co.
Ohio Brass Co.
Westinghouse Electric & Mfg. Co.
INSULATORS, SECTION
American Mine Door Co.
General Electric Co.
Ohio Brass Co.
Westinghouse Electric & Mfg. Co.
INSULATORS (Porcelain)
General Electric Co.
Ohio Brass Co.
Westinghouse Electric & Mfg. Co.
INSULATORS (Third Rail)
General Electric Co.
Ohio Brass Co.
INSULATORS (Trolley)
General Electric Co.
Ohio Brass Co.
Westinghouse Electric & Mfg. Co.
INSULATED WIRE AND CABLE
American Steel & Wire Co.
General Electric Co.
Roebling's Sons Co., J. A.
KEROSENE
Standard Oil Co. (Ind.)
KEYSTONE GREASE
Keystone Lubricating Co.
KEYSTONE GREASE CUPS
Keystone Lubricating Co.
KEYSTONE SAFETY LUBRICATORS
Keystone Lubricating Co.
KILNS (Rotary)
Allis-Chalmers Mfg. Co.
Vulcan Iron Works.
KILNS, VERTICAL
Vulcan Iron Works.
LAMP CORD
American Steel & Wire Co.
Roebling's Sons Co., J. A.
LAMPS, ARC AND INCANDESCENT
General Electric Co.
Westinghouse Electric & Mfg. Co.
LAMPS (Edison Electric)
Mine Safety Appliances Co.
LEAD BURNING APPARATUS, Oxy-Acetylene, Oxy-City Gas
Oxweld Acetylene Co.
LIGHT AND POWER PLANTS (Small)
Westinghouse Electric & Mfg. Co.
LIGHT STEEL ANGLES
Carnegie Steel Co.
LIGHT STEEL RAILS
Carnegie Steel Co.
West Virginia Rail Co.
LOADERS, Gravel and Sand
Joy Manufacturing Co.
Link-Belt Co.
LOADERS (Mine Car)
Goodman Mfg. Co.
The Jeffrey Mfg. Co.
Joy Manufacturing Co.
Link-Belt Co.
Myers-Whaley Co.
LOADERS, PORTABLE
Goodman Mfg. Co.
The Jeffrey Mfg. Co.
Joy Manufacturing Co.
Link-Belt Co.
Myers-Whaley Co.
LOADERS, Snow
Joy Manufacturing Co.
LOADERS, Truck
Joy Manufacturing Co.
Link-Belt Co.
LOADERS, Wagon
Joy Manufacturing Co.
Link-Belt Co.
LOADING BOOMS
Connellsville Mfg. & Mine Supply Co.
The Jeffrey Mfg. Co.
Link-Belt Co.
Roberts & Schaefer Co.
United Iron Works, Inc.
LOADING MACHINES
Connellsville Mfg. & Mine Supply Co.
Conveyor Sales Co.
Goodman Mfg. Co.
The Jeffrey Mfg. Co.
Link-Belt Co.
Myers-Whaley Co.
LOCOMOTIVES, ELECTRIC
General Electric Co.
Goodman Mfg. Co.
The Jeffrey Mfg. Co.
Westinghouse Electric & Mfg. Co.
LOCOMOTIVES, GASOLINE
Vulcan Iron Works.
Westinghouse Electric & Mfg. Co.
LOCOMOTIVES, RACK RAIL
Atlas Car & Mfg. Co.
Goodman Mfg. Co.
LOCOMOTIVES, STEAM
Vulcan Iron Works.
LOCOMOTIVES, STORAGE BATTERY
Atlas Car & Mfg. Co.
General Electric Co.
Goodman Mfg. Co.
The Jeffrey Mfg. Co.
Vulcan Iron Works.
Westinghouse Electric & Mfg. Co.
LOCOMOTIVE SWITCHING & WRECKING ROPES
Roebling's Sons Co., J. A.
LOCOMOTIVES (Third Rail)
Atlas Car & Mfg. Co.
Goodman Mfg. Co.
LOCOMOTIVES, TROLLEY
Atlas Car & Mfg. Co.
General Electric Co.
Goodman Mfg. Co.
Vulcan Iron Works.
Westinghouse Electric & Mfg. Co.
LONGWALL MACHINES
Goodman Mfg. Co.
Sullivan Machinery Co.
LUBRICANTS
Keystone Lubricating Co.
Standard Oil Co. (Ind.)
LUBRICATING DEVICES
Keystone Lubricating Co.
LUBRICATING GREASES
Keystone Lubricating Co.
LUBRICATING ENGINEERS
Keystone Lubricating Co.

LUBRICATORS
Keystone Lubricating Co.
MACHINE OILS
Standard Oil Co. (Ind.)
MACHINERY, TRANSMISSION (Power)
Allis-Chalmers Mfg. Co.
Link-Belt Co.
Morse Chain Co.
MANIFOLDS, OXYGEN
Oxweld Acetylene Co.
MAST ARM ROPE, Galvanized
Roebling's Sons Co., J. A.
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Mine Safety Appliances Co.
MILL GREASES
Standard Oil Co. (Ind.)
MILLS, ROD & BALL
Allis-Chalmers Mfg. Co.
MILLS, STAMPS
Allis-Chalmers Mfg. Co.
MINE CAR AXLES
Hockensmith Wheel & Mine Car Co.
MINE CAR BEARINGS
Hyatt Roller Bearing Co.
Timken Roller Bearing Co.
MINE CAR BOXES
Hockensmith Wheel & Mine Car Co.
MINE CAR FORGINGS
Hockensmith Wheel & Mine Car Co.
MINE CAR LUBRICANTS
Keystone Lubricating Co.
Standard Oil Co. (Ind.)
MINE CAR PARTS
C. S. Card Iron Works Co.
Hockensmith Wheel & Mine Car Co.
Phillips Mine & Mill Supply Co.
MINE CARS
Atlas Car & Mfg. Co.
C. S. Card Iron Works Co.
Enterprise Wheel & Car Corpn.
Hockensmith Wheel & Mine Car Co.
Phillips Mine & Mill Supply Co.
United Iron Works, Inc.
MINE CAR TRUCKS
United Iron Works, Inc.
MINE CAR WHEELS
C. S. Card Iron Works Co.
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United Iron Works, Inc.
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American Mine Door Co.
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American Steel & Wire Co.
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MINE TIES, CREOSOTE TREATED
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Allis-Chalmers Mfg. Co.
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Goodman Mfg. Co.
Ingersoll-Rand Co.
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MINING MACHINES (Electric)
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MINING MACHINERY BEARINGS
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MINING MACHINERY LUBRICANTS
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Linde Air Products Co.
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Mine Safety Appliances Co.
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Sullivan Machinery Co.
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General Electric Co.
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PUMPS, AIR LIFT
Ingersoll-Rand Co.
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"AS our Wyoming property will load approximately 1,750,000 tons with electrically-driven mechanical coal loading equipment of various types during the calendar year 1929, I am sure that this phase of our operation will appeal to coal mining men throughout the country."

EUGENE McAULIFFE,
President,
Union Pacific Coal Company.

Featuring The UNION PACIFIC COAL CO.—
1,750,000 tons

Articles about the Union Pacific Coal Company to appear in the February issue

(1) INTRODUCTION by Mr. Eugene McAuliffe.
(2) TOWNS AND DWELLINGS by Mr. George B. Pryde.
(3) HISTORY OF UNION PACIFIC MECHANIZATION by Mr. A. W. Dickinson.
(4) SOCIAL ACTIVITIES by Miss Jessie McDiarmid.
(5) POWER by Mr. D. C. McKeehan.
(6) MACHINE INSTALLATIONS by Mr. A. T. Kenhell.
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(9) HANDLING EXPLOSIVES by Mr. M. W. Medill and Mr. Foote.
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(12) PHOTOGRAPHY by Mr. N. Williams.
(13) TIME STUDIES by Mr. R. Knill.
(14) METHODS OF ACCOUNTING by Mr. Frank Tallmire.
(15) STORES by Mr. E. R. Jefferis.
(16) HISTORY AND DEVELOPMENT OF MECHANIZATION AT HANNA MINES by Mr. O. G. Sharrer.
(17) MECHANICAL OPERATION AT HANNA MINES by Mr. J. V. McClellan.
(18) MECHANIZATION AT SUPERIOR MINES by Mr. G. A. Brown and F. V. Hicks.
(19) MECHANIZATION AT WINTON MINES by Mr. Thos. Foster.
(20) MECHANIZATION AT ROCK SPRINGS MINES by Mr. T. H. Butler and Mr. Edgeworth.

This interesting issue will inaugurate the valuable series of Industry Numbers that will appear throughout 1930 in The MINING CONGRESS JOURNAL. Others of this series will be the *COPPER, ANTHRACITE, LEAD and ZINC, IRON and the COAL EXPOSITION* issues. This material in addition to regular features. 1930 will be a big year for our readers.

The FEBRUARY Issue of
The MINING CONGRESS JOURNAL

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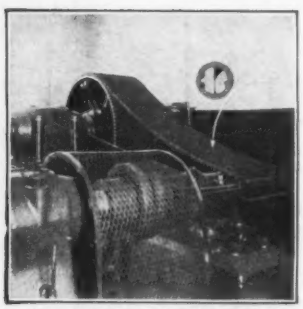

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